# PUBLIC WORKS

Feb.

CITY, COUNTY AND STATE

ROAD MANAGEMENT pays off for a County page 85

Getting a good start on STORM SEWER DESIGN page 91

Rating the decomposition efficiency of SANITARY LANDFILLS page 102

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Dr. C. M. Palmer, aquatic biologist of the U. S. Public Health Service, who has received a special award for his work on algae identification at the Robert A. Taft Sanitary Engineering Center. More data on page 23.



TO MINIMIZE TRAFFIC INTERFERENCE on busy Belmont Boulevard, two cuts at a time are being made on long job of replacing clamps on Nashville, Tenn. gas mains. The cuts (30" sq. and 26" average depth) are

backfilled immediately with hot mix tamp. The compressor used is a Jaeger Air-Plus Roto<sup>®</sup> "125" because it has the capacity to run both breakers at full efficiency yet is easily trailed and light enough to spot by hand,



BACKFILLING 7 MILES OF TRENCH, A. J. Ellis Construction Co., College Park, Md. are here using a Jaeger Roto "125" with a triplex tamper. Job is laying 35,000'

of 24" gas transmission line for Washington Gas Light Co. User reports: "We liked our first Jaeger Rotary so well we bought two more."

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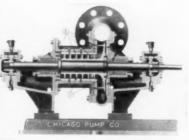
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Chemical Building at City of Warren's new water works.

Cat D397 protects Warren's water supply.

The City of Warren, Ohio—awarded the title of "All-America City, 1955"—has a water system that's a model for communities of its size. In normal operation three electrically driven pumps handle an average of 10 to 12 million gallons a day. Water is taken from three different elevations in Mosquito Lake, screened, pumped to the chlorination plant, passed on to the settling basins, filtered and finally pumped into the city mains.

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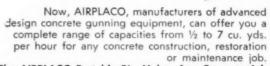
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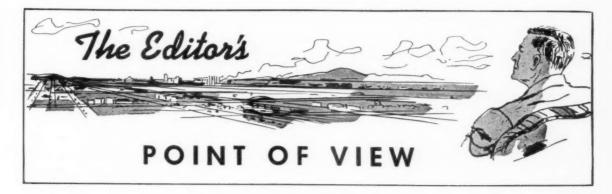


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### A Positive Program for Getting More Of These Much-Needed Engineers

COR A VARIETY of reasons, there are too few engineers to meet our present-day needs. While it may be of value, as a guide to the future, to analyze and discuss these reasons, it is better right now to take some positive steps to remedy the deficiency. This means getting more young men interested in taking college civil engineering courses. As a step toward accomplishing this, PUBLIC WORKS has asked twelve outstanding engineers in civil and public works engineering to tell of the opportunities and rewards that exist in the various areas represented. These articles will be published in groups of four, during the next few months. Reprints will be furnished without charge to engineering college professors for distribution to high schools and elsewhere. We hope this program will spark other efforts to develop a greater interest and participation in the highly important and rewarding field of public works.

#### Research Suggestions Are Invited

A RESEARCH Foundation was organized last year by the American Public Works Association. Its purpose is to develop, initiate and foster research projects which will be of value to the men engaged in the public works field and to the cities, counties and states they serve.

Suggestions for broadly useful and practical research projects are invited. Send them to The Editor, Public Works Magazine, 200 So. Broad St., Ridgewood, N. J. He will submit them to the Research Foundation Trustees.

### Mechanizing Public Works Engineering Procedures

OVER THE past few years, mechanization has made great strides in some areas of our city, county and state engineering work. The progress as measured in real potential has, however, been small. The motor grader, the tractor, the front end loader, the self-loading and compacting refuse vehicle and the catch basin cleaner are, along with a score of other devices, standard equipment. Yet in too many places, such jobs as mak-

ing surveys, closing a traverse, computing earthwork and designing a manhole or bridge abutment, require hours of engineering work. Not only is the cost increased, but the time required to get the job finished puts an automatic limit on the amount of work that can be done. A greater use of electronic equipment, of aerial surveys and of standardized design details would reduce cost, speed up office and design work and permit use of available engineering skills for the higher echelons and for advance planning and programming which is vitually needed.

# What Labor's 32-hour Work Week May Mean to Public Works

ABOR IS talking about a 32-hour work week and, if we look back over the history of the labor movement, we can pretty well expect this to come to pass sometime in the future foreseeable for most of us. What will be the effect of such a short week on the needs for public works? No one can predict precisely, but some things are fairly evident. First of all, probably, is a far greater use of our highway system, already inadequate; so more and better roads are surely going to be needed. The shorter work week will probably intensify the move to the suburbs and more residential developments will bloom, with demands for more streets, for water, for sewerage and for other waste collection services. With more time to care for lawns, gardens and flowerbeds, there will be a growing use of water, continuing the increase in use that most water works folks have yet scarcely realized. Effect on sewerage will probably be confined to construction of new lines, the problems of sanitating residential developments and spot problems in many places which will find themselves growing beyond expectation.

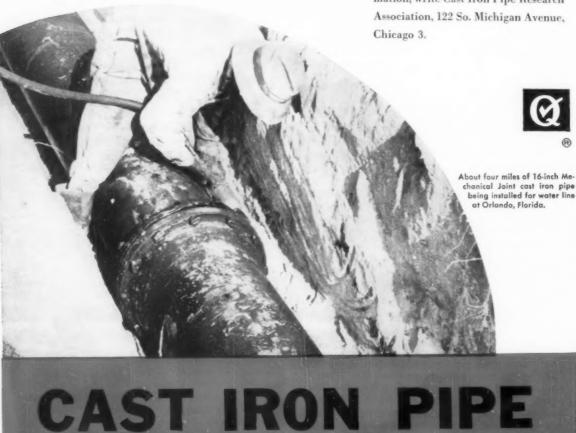
The problems of handling what are really urban areas outside of municipal limits must be eased by those states now having laws inadequate for handling such situations. Such states should find some legal method of providing the needed facilities without the delay that is now inevitable in so many cases, due to the cumbersome and inapplicable laws in force.

# When you use it



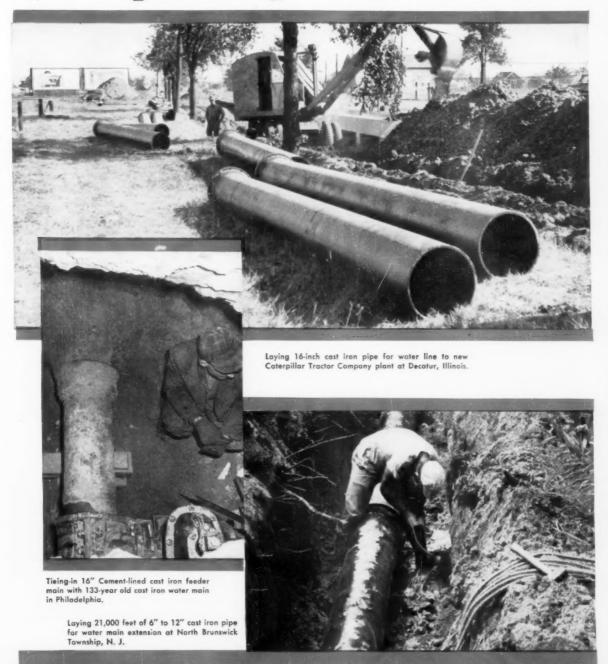
Installing 6-inch Mechanical Joint cast iron pipe for pressure sewer river crossing to sewage treatment plant at Marquette, Mich.

If you were to put your own money in a pipeline that should be as nearly permanent as brains, hands and machines could make it, what pipe would you buy? Cast Iron Pipe, undoubtedly! And why? Because cast iron mains are in their second century of service in nearly seventy cities. Modernized cast iron pipe, as made today, is even tougher and stronger. Since everybody pays taxes, one way or another, everybody benefits when you install long-lived cast iron pipe. For further information, write Cast Iron Pipe Research Association, 122 So. Michigan Avenue, Chicago 3



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SERVES FOR CENTURIES...

# Ten-Year Sanitary Landfill Program at Jackson, Mississippi — an Outstanding Example

City now operates several sites, handles all refuse at one-fourth former cost

The city of Jackson, Mississippi, switched to the sanitary landfill method of handling its refuse back in 1945. Now its 25 trucks pick up approximately 40,000 tons of rubbish and garbage a year, take it outside the city where landfill operations appropriate to each site are carried out.

The newest of Jackson's tractor equipment is a 2½-yd HD-11G

tractor shovel, the third new Allis-Chalmers tractor purchased by the city in the past three years. The operator says that this new 11G does the job clean and fast, and made a particular point about its ability to handle tough digging. With the unit operating according to the trench method, it is an important advantage for the 11G to be able to cut even when the ground is particularly hard.



The result — where there was formerly only useless land, now there are golf courses and parks.



The method — sanitary landfill. Here refuse is crushed and compacted against the ramp end of the trench.



The new HD-11G is becoming an increasingly popular municipal unit. With 105 net engine horse-power, 2½-yd bucket capacity and 32,000 lb of balanced weight, it can

handle a wide variety of jobs efficiently and at low cost. Your Allis-Chalmers dealer will be glad to give you all the facts, plus an on-thejob demonstration. Call him today.

The equipment — an Allis-Chalmers 2½-yd HD-11G tractor shovel. Here it cuts cover material by extending the trench, spreads it over the refuse to provide a sanitary seal.

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The Tunnelugger backs off with the pipe still on the arms to set it firmly in place, assuring an even, tight joint.

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The new two-way Tunnelugger can operate in either direction from a centrally located shaft—quickly delivering and positioning Inner Circles at either end while digging continues at the other.

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# Washington news

Presented in cooperation with the American Public Works Association and through the courtesy of the Washington Office of the American Municipal Association

# The State of the Union . . . and Public Works

President Eisenhower renewed his plea for a big scale interstate road building program in his State of the Union message which was submitted to Congress, January 5, 1956. The following excerpts from his message will be of especial interest to public works officials.

Highways - "Legislation to provide a modern, interstate highway system is even more urgent this year than last, for 12 months have now passed in which we have fallen further behind in road construction needed for personal safety, the general prosperity, the national security of the American people. . . . If we are ever to solve our mounting traffic problem, the whole interstate system must be authorized as one project, to be completed approximately within the specified time. Only in this way can industry efficiently gear itself to the job ahead. Only in this way can the required planning and engineering be accomplished without the confusion and waste unavoidable in a piecemeal approach . . . As in the case of other pressing problems, there must be an adequate plan of financing. To continue the drastically needed improvement in other national highway systems, I recommend the continuation of the federal aid highway program.

Water Conservation-"A comprehensive legislative program for water conservation will be submitted to the Congress during the session. The development of our water resources cannot be accomplished over night. The need is such that we must make faster progress and without delay. Therefore, I strongly recommend that action be taken at this session on such wholly federal projects as the Colorado river storage project and the Frying Pan-Arkansas project; on the John Day partnership project, and other projects which provide for cooperative action between the federal government and non-federal interests; and on legislation which makes provision for federal participation in small projects under the primary sponsorship of agencies of state and local government.

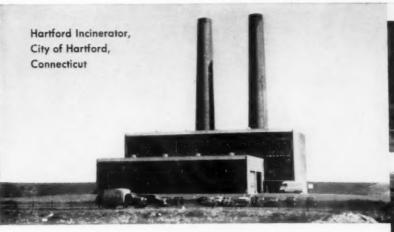
School Construction - "I urge that the Congress move promptly to enact an effective program of federal assistance to help erase the existing deficit of school classrooms. Such a program which should be limited to a five-year period, must operate to increase rather than decrease local and state support of schools and to give the greatest help to the states and localities with the least financial resources. Federal aid should in no way jeopardize the freedom of local school systems. There will be presented to the Congress a recommended program of federal assistance for school construction.

Public Housing—"The administration will propose authority to contract for 35 thousand additional public housing units in each of the next two fiscal years for communities which will participate in an integrated attack on slums and blight.

Disaster Assistance—"Through the past three years, the administration has repeatedly moved into action wherever disaster struck. The extent of state participation in relief activities, however, has been far from uniform and in many cases, has been either inadequate or nonexistent. Disaster assistance legislation requires overhauling, and an experimental program of flood-damage indemnities should be undertaken."

#### Airport Funds for Clear Zones

The American Society of Planning Officials reports that about one-third of the 205 airports that will receive grants this year from the federal airport program will use at least part of the funds to acquire land for clear zones at the ends of runways. Clear zones are areas beyond the take-off or landing strips, half a mile long and





(1) Hartford's Fitchburg Chipper

# **Modern Hartford disposal plant** USES FITCHBURG CHIPPER

Hartford's new municipal incinerator is used to dispose of more than 400,000 pounds of waste every day. The large picture above shows this efficient, attractive plant-one of the most modern in the nation.

An important part of Hartford's up-to-date disposal program is their portable Fitchburg Chipper, which cleans up disposal jobs the incinerator cannot handle, and goes out on location for road use.

# Hartford had these problems:

• Banana Stalk Disposal • Brush Disposal on New Roads • Christmas Tree Disposal • Road Clearance from Storm Damage

# How a Fitchburg Chipper solves these problems:

Joseph J. Coffey, Superintendent of the Hartford Incinerator, tells you in his own words how Hartford solves these problems: BANANA STALKS: "We chip 2 to 4 tons of banana stalks each week. These stalks will not burn regardless of heat in the furnaces, and we had to dump them until the Fitchburg Chipper went on duty." CHRISTMAS TREES: "During the post-Christmas season we receive many Christmas trees which we can now get rid of without the trouble of watching for burnt-down spike-like stubs which cause much trouble with the incinerator equipment."

BRUSH DISPOSAL: "Our Highway Division has used our Fitchburg Chipper to clean up the brush and branches along newly developed road areas. By chipping brush, the city saves in use of both manpower and trucking costs." ROAD CLEARANCE: "If we get hit again by hurricanes or bad wind storms, we now have an excellent piece of equipment that will enable us to readily open up the streets for emergency traffic by reducing the fallen branches to chips.'

As to maintenance, Mr. Coffey says: "Our Fitchburg Chipper will pay for itself in a very short time. Maintenance, so far, is just keeping it supplied with gasoline and fully lubricated. It is easy to handle, easy to store, and very easy to use."

Mail coupon for big, FREE, colorful booklet. Get the facts! Specifications, operating data, explanation of exclusive Fitchburg Safety Spring, actual letters from users.

# ENCINEERING



(2) Fitchburg Chipper in action

# Read what leading Fitchburg users say

#### LINE CLEARANCE

The Shade Tree Service Company, Webster Groves, Mo.: "Our figures show that production has been increased by a good 25% with the use of the Fitchburg Chipper. One man can operate the chipper with ease. He alone can handle as much, and more, brush in the same length of time as could two men loading brush on a platform body."

#### **POWER COMPANY**

Rockland Light and Power Company, Nyack, N. Y .: "Our men have been particularly pleased with their Fitchburg Chippers. They are rugged and reliable and the convenience of flexible, yet instant brush disposal has the advantage of promoting good public relations and still gives us efficiency."

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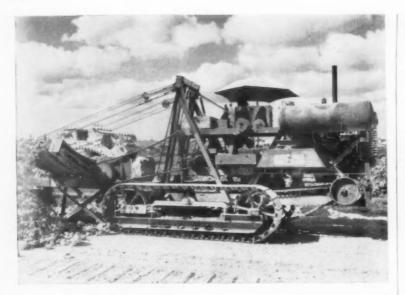


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Send my Free Chipper Booklet.

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# Cleveland "140" <u>halves</u> 90-day time limit...digs 44,500 feet Florida coral rock in 45 days

Under contract to dig over 8 miles of water line trenches within 90 days, C.B.S. Excavators of Miami finished the job in just half that time using a fast-moving Cleveland "140" Trencher.

The "140" cut trench through solid coral rock for over 40,000 feet of lines in Miami's Westview Homes Subdivision and for the mile-long main connecting the system to the water plant. Trench for the 6-, 8-, 10- and 12-inch pipe was 20 inches wide and 42 inches deep. In addition to the extensive coral rock, the trenching operation was further complicated by seepage of water into the partially-dug trench in some areas of the subdivision.



"No other machine can match it," owner P. F. Chambers says of his Cleveland "140". "For its size this machine can do more trenching than any other. We use the same machine for digging utilities lines and house footings. It really does a fine job of cutting to grade."

See your local distributor

THE CLEVELAND TRENCHER COMPANY . 20100 St. Clair Ave., Cleveland 17, Ohio



1,000 feet wide, and free of housing or any other kinds of buildings. This location was found by a federal inquiry to be the site of the most airplane crashes that took the lives of persons on the ground.

The Civil Aeronautics Administration, which has charge of the federal aid airport program, will permit airports to make agreements with owners of nearby land, when they cannot take title to the land, provided the agreements allow adequate control of the surface. Federal funds are also being used by airports to acquire land to remove obstructions in "approach zones"—those areas past the clear zones in which buildings are permitted as long as they are not too

The society noted that the report of the same federal inquiry—the 1952 Doolittle commission—recommended that for safety's sake the controlled area past the clear zone should extend at least two miles beyond the clear zone and be at least 6,000 feet wide at its outer edge. The report said that regulations should forbid the location in approach zones of churches, hospitals, schools, and other places where groups of people meet and should restrict the location of residences within the zone of the places farthest away from the airport.

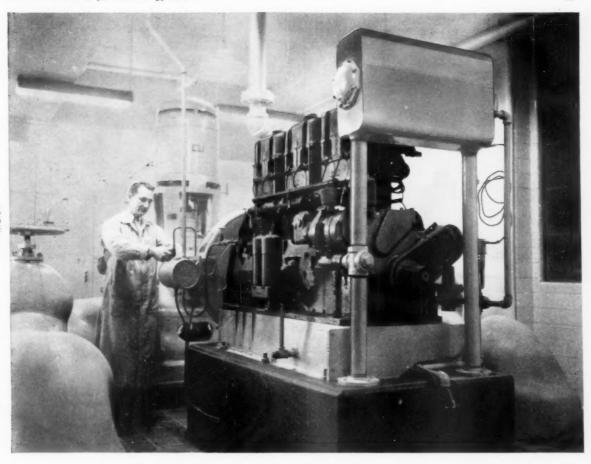
### Collections of Garbage and Combustible Refuse

Collections of garbage and combustible refuse in Cuyahoga Falls, O., during 1955, amounted to 576 pounds per capita, based on 11 months of operation. This compared to 1954 collections of 551 pounds per capita. Populations were estimated at 39,470 for 1955 and 38,211 for 1954.

#### Sewage Treatment and Sludge Utilization in Milwaukee

The sewage treatment plant of Milwaukee, in 1954, handled an average of 162 mgd of sewage, producing 61,698 tons of Milorganite. The treatment process brought about an average reduction of 95 percent in bacteria, 94 percent in biochemical oxygen demand, and 93 percent in suspended solids, resulting in a clear, high grade effluent being discharged into Lake Michigan. The market demand for Milorganite exceeds its production. The returns from its sale are less than the cost of processing the sludge, but to dispose of it in other ways would entail additional costs.

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The operator of the Le Roi F1500 shown above said, "This engine has surpassed our every requirement for standby power, and has more than paid for itself with dependable, economical, power production when we needed it most."

That's typical of the results experienced by Le Roi engine users everywhere. But you get more than just dependability. You get economy.

For example, Le Roi engines are so compact that you save on installation costs. Volume production and post-war designs give you more horsepower per dollar. Also, because Le Roi engines can use the lowest cost fuels available, savings in operating costs are important, too. We have some engines that have saved taxpayers over \$4000 a year for 14 years others that have saved \$7600 in a 10-month period. And so it goes.

You, too, can save your taxpayers' money and still provide them with the services they need, by using Le Roi engines. Sizes range up to 655 hp, or in custom generator sets from 50 to 350 KW. And all Le Roi's operate on natural gas, LPG, gasoline, or no-cost sewage gas. Write us for our latest literature.

E-108

# Division of Westinghouse Air Brake Co. Milwaukee 1, Wisconsin







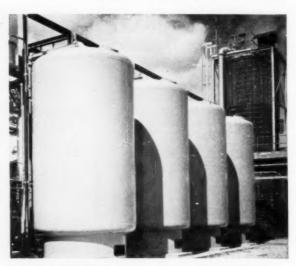








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Growing U. S. cities and towns are faced with using lower-grade water. Results: increased hardness, turbidity, iron, high CO<sub>2</sub> "aggressive waters", other problems . . . complaints from homeowners, businesses, industries.

 For expert answers more and more waterworks officials and their consultants are buying the complete service offered by leading water-conditioning firms. Here's how Permutit (rhymes with "compute it"), a pioneer and largest in the field, tackles a water problem:  Water analysis, study of the problem and past experience provide data on possible methods of treatment. The process offering the best balance of initial and operating cost vs. desired quality of treated water is selected.

 Complete proposal by Permutit engineers covers type, size and capacity of equipment, price, any special engineering services and performance guarantees.

• Manufacturing — After the proposal is accepted, Permutit designs the entire

project, schedules assembly and shipping. Critical parts, ion exchange resins, control panels are all made in Permutit plants. (No other U. S. firm makes all these components.)

• Test runs — Where required, Permutit checks the installation, supervises start-up and initial operation, trains permanent operating personnel.

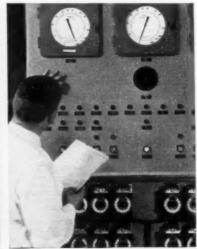
• For further information look up the Permutit office in your city or write to The Permutit Company, Dept. PW-2, 330 West 42nd St., New York 36, N. Y.



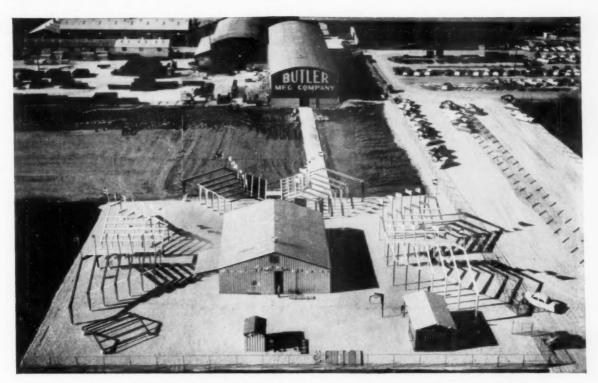
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AUTOMATIC CONTROLS to ensure optimum results are designed, assembled, wired and tested by Permutit.



Helicopter's eye-view of Butler's new building display at Galesburg, Illinois plant. Central building incorporates engineering refinements. Surrounding forest of rigid frames demonstrates variety of widths, side-wall heights, and code-complying structurals now available up to fifty feet wide (wider rigid frames are also available but not shown).

# What's NEW with Butler?

New economy for one thing! Butler now offers eleven times more sizes and types of factory-built metal buildings than ever before. Whatever your space needs . . . Butler comes closer to giving you the exact-size building you require than any other metal building manufacturer. That means closer pricing . . . and no compromises on size!

New code engineering for another! Butler buildings meet all state and local codes. Engineering costs and delays are minimized. You literally order the building you want — from your Butler Builder.

New engineering refinements throughout! Newest, most modern wedge-shaped design gives Butler rigid frames greatest strength per pound of steel. New high-strength bolts are used in frame assembly. That increases holding power with fewer bolts, fewer manhours of erection costs.

New fluted wall panels. All Butler wall panels are now fluted, resulting in a more pleasing appearance and greater rigidity. Panels are mitered to form a tight joint with roof panels, and are crimped at base and windows for weather-tightness.

But that's just part of the story. It is all described in Butler's new 16-page booklet that details the new designing, new features and new values. Why not clip and mail the coupon below, today!



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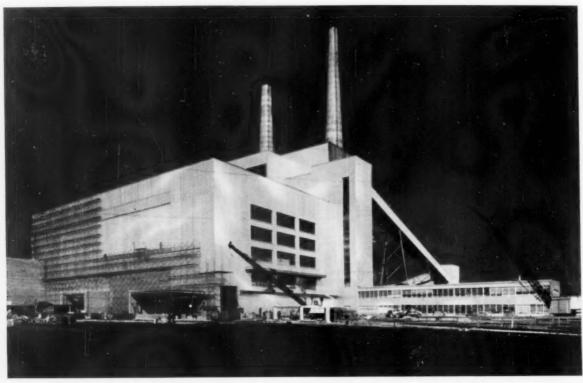
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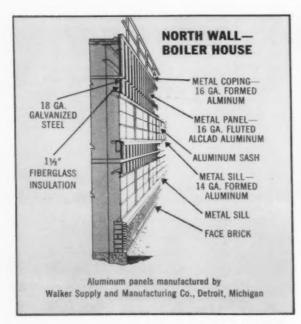
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# **Detroit Edison estimates big**



Detroit Edison Company's new generating station at River Rouge, Michigan—constructed with outside walls made of Kaiser Aluminum selected and fabricated by Walker Supply

and Manufacturing Co., Detroit, Michigan. This unique design reduces structural steel tonnage, foundation requirements and maintenance costs.





Insulation Coverings made of Kaiser Aluminum protect insulating materials from moisture and mechanical damage. Resist corrosion. Won't rust. Give long service without painting and with virtually no maintenance. Aluminum coverings also provide high reflectivity, low emissivity for greater protection against heat loss. Light weight reduces handling and transportation cost.

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# savings by the use of lightweight aluminum walls!

The Detroit Edison Company selected light, strong aluminum sheet and extrusions for the outside walls of their new generating station at River Rouge, Michigan.

This unique, lightweight wall design allows an 8,000-ton reduction in total weight and reduces structural steel and foundation requirements—as compared to the 12" masonry curtain-type walls used in previous plants.

Another important reason aluminum was selected for this job is its high resistance to corrosion—especially necessary in the industrial atmosphere of the River Rouge site. Re-

sult: maintenance on the exterior walls is kept to a minimum.

As a basic producer of aluminum, our efforts are dedicated to the job of helping to improve building products and to reduce their costs.

We will gladly share with you to the fullest our fabricating and engineering skills. Or for names of building products manufacturers who will be glad to work with you, contact the Kaiser Aluminum sales office listed in your telephone directory. Kaiser Aluminum and Chemical Sales, Inc., General Sales Office, Palmolive Bldg., Chicago 11, Ill.; Executive Office, Kaiser Bldg., Oakland 12, Calif.

# Kaiser Aluminum

setting the pace-in growth, quality and service

### More ways to cut costs with aluminum building products!

Kaiser Aluminum Shade Screening keeps buildings as much as  $15^{\circ}$  cooler under the hottest summer sun. This reduces the load on air conditioning equipment—thus reducing operating costs. The  $17^{\circ}$  angle of the louvers blocks direct rays of the sun, yet provides glarefree light.

Ventilation Louvers made with Kaiser Aluminum won't rust or rot—never stain adjacent surfaces. Require less maintenance, fewer replacements. Cost less than building material they replace. So easy to handle that construction is faster, lower in cost. Light weight also reduces transportation costs.

Air Conditioning and Heating Duct Systems made with lightweight Kaiser Aluminum go up faster—cut erection costs almost 12%. Pound for pound, cover three times the areas of galvanized ducts. Deliver 17 to 46% more heat due to aluminum's low emissivity. Easy to fabricate and erect.

# NEW HOMELITE Diaphragm PUMP

#### \*120 pounds for easier carrying Model 20DP3 has guaranteed suction lift up to 28 feet and total head up to 50 feet, including friction.

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This new, job-tested Homelite diaphragm pump will handle all your heavy-duty jobs with greater ease and mobility.

Its new internal design not only pumps up to 5000 gallons per hour but handles sand, mud, solids and muck with equal ease. Because it weighs only 120 pounds, it goes anywhere quickly and easily . . . saves money in labor and haulage costs.

The entire unit construction is keyed to smooth, continuous performance. Flapper valves have special self-cleaning action to prevent clogging. The accumulator holds flow at a steady rate. Gears are totally-enclosed for full protection. Spring skids provide steadier footing, reduce vibration.

Write or call your nearest Homelite representative for complete information or a free demonstration.

# HOMELITE

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# AWARDS PRESENTED TO

# Dr. C. M. Palmer and Harold J. Walter



Harold J. Walter, artist-biologist who painted the algae charts published in the June 1955 issue of PUBLIC WORKS, has been awarded \$200 in recognition of his achievement. The charts, prepared under the direction of Drs. C. M. Tarzwell and C. M. Palmer, aquatic biologists at the Robert A. Taft Sanitary Engineering Center of the Public Health Service at Cincinnati, have received wide and favorable notice from sanitary engineers and scientists in the field. The award given to Mr. Walter was made under the Federal Employees Incentive Awards Program. on the recommendation of the Board of Employee Awards of the Sanitary Engineering Center. Mr. Walter is now engaged in graduate studies at the University of Michigan. The charts are to be reproduced by the U. S. Government Printing Office in a Public Health Service manual on algae of significance in water supplies.

Dr. Palmer has also figured in an SEC achievement award recently. He received \$250 for his successful development of a special microscope slide for counting algae in water samples. Known as the Palmer nannoplankton counting cell, the device is precision made of glass and is in commercial production by two manufacturers of scientific instruments. It is easily filled, has a capacity of 1/10-ml, and can be used under high magnification.

Dr. Palmer, who is shown on our front cover at work with his special microscope counting slide, is a graduate of Pennsylvania State University and of Indiana University. He taught and directed research on microbiology and botany at Butler University from 1925 to 1950. With Dr. C. K. Calvert, he made an extensive study and survey of the White River to determine the effect of the Indianapolis sewage treatment plant effluent. Later he was with UNESCO in South Asia. At the Robert A. Taft Sanitary Engineering Center, in Indianapolis. where he is now stationed, he is head of the Nuisance Organisms Research Unit of the Water Supply and Water Pollution Control program.



 HAROLD J. WALTER, artist-biologist, working on one of the beautifully prepared and colored algae charts for which he received a special recognition award.

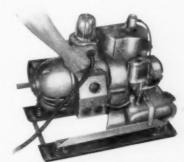
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# Sewage Pump Well Elevation Held at 114.5'±3" Despite Big Variations in Flow



Three of four E-M 200 hp, 1200 rpm Vertical Synchronous Motors with Adjustable-Speed Magnetic Drives at Nut Island Sewage Treatment Plant of the South Metropolitan Sewage System in Quincy, Massachusetts.

E-M Vertical Synchronous Motor and Magnetic Drive Unit for adjustable-speed power transmission to vertical centrifugal pump. The ring element (1) mounted directly on the motor shaft turns at motor speed. The magnet element (2), mounted

inside the ring element, has no mechanical connection to the motor . . . torque is transmitted through magnetic flux linkage between ring and magnet. By varying amount of excitation to magnet, pump speed can be precisely controlled.

# AMAZINGLY PRECISE CONTROL OF SEWAGE PUMPS OBTAINED WITH **E-M** ADJUSTABLE-SPEED MAGNETIC DRIVES

One of the critical problems in operating Boston's new Nut Island Sewage Treatment Plant is complete control over the wide daily, weekly or seasonal flow variations. For example, flows may vary from 63 mgd to 249 mgd, with peak loads of nearly 300 mgd during stormy periods.

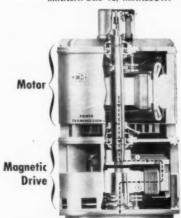
The pump well has to maintain an elevation of 114.5 feet with not more than 3 inches variation, to assure proper levels and flow velocities in the sewage processing channels. Control of the output of the low-lift sewage pumps has to be fast and remarkably accurate.

Use of E-M Adjustable-Speed Magnetic Drives for the low-lift pumps provides the sensitive speed control necessary in maintaining this close command of the pump well elevation.

Pump speed changes are dictated by a well float that actuates the Magnetic Drive through an E-M "Regutron" Control. Pump speed is automatically increased or decreased to maintain precisely the required pump well elevation. The Magnetic Drives are highly important and effective factors in most efficient operation of the Nut Island Sewage Treatment Plant for eliminating pollution in Boston Harbor.

For more information, see your nearest E-M sales engineer. And write direct for a copy of E-M Synchronizer No. 38 which tells the complete story of this outstanding installation.

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# CATERPILLAR

# HOW WATERLOO TURNED GARBAGE DISPOSAL FROM A LIABILITY INTO AN ASSET

Playgrounds reclaimed from dumps property values increased near homes and a polluted creek filled—these are some of the benefits resulting from nine years of sanitary landfill.

When Waterloo, Iowa, was using the open dump system of garbage disposal, the Mayor often received requests like this: "We're having a party tonight, Mayor. Could you stop burning rubbish at the dump?" Worst of all, the city fathers were constantly worried about possible lawsuits brought about by the unsightly, unsanitary dumps, which were breeding places for rats, flies and vermin.

Many people accepted this condition as a necessary evil. But not Carl C. Fagerlind, Waterloo Street Commissioner, who proposed the sanitary landfill method of disposal. He explained this in terms taxpayers could understand. "You just find a low area and dump your garbage there. You spread the refuse out, then run over it with one of those big crawler tractors. This

squashes everything together, then you cover the refuse with about two feet of dirt. Flies or rats can't get to the refuse and it can't burn.

"The real payoff comes afterward, though. You keep piling layers of dirt and garbage into the low spot, and when it is filled you've got brand-new land for buildings or a park."

The city fathers thought the idea had merit. They told Fagerlind to "Take one of the city's tractors and see what we can do at our present dumping site. We can't spring this on the city until we are sure we know, how to operate a successful landfill."

After Fagerlind had convinced them that he had the know-how, the next step was to promote sanitary landfill to other city officials, the park board, the planning commission and influential



Carl Fagerlind, Waterloo Street Commissioner, was the prime mover in the city's adoption of sanitary landfill. About 20 acres of land have been reclaimed since the operation started in 1947.



Turning a dump into a baseball diamond is just one example of the improvements made in Waterloo by use of sanitary landfill. A few feet under this field are tons of garbage.

Waterloo business leaders. The Mayor, actively supporting his Street Commissioner, carried his proposal in a series of talks to service clubs, to the League of Women Voters and the press. Finally, the City Council felt the story had reached enough people and Fagerlind was instructed to go to work on his first project, the Fairview Dump.

This dump, next to beautiful Cedar Rapid Park and just a short distance from the municipal baseball stadium, was overrun with rats. Fires burned night and day and baseball games were frequently interrupted when the outfielders could not see through the fog of smoke that drifted over the field.

Using the landfill method, Fagerlind and his crews converted this public nuisance into a playground. So successful was the conversion that people from



This Caterpillar\* D7 Tractor with No. 7S Bulldozer is the mainstay of Waterloo's sanitary landfill operation. Its giant tracks can squeeze refuse to one-fourth of its original size. Good compaction is essential

in landfill. This, plus solid packing of earth over the refuse, eliminates vermin and odors and prevents fires. Eventually, grass seed is sown and the area becomes a community asset.

all sections of the city offered him other sites for reclamation. As a result, among other improvements in the last nine years, there's a dike along the Cedar River that protects about 20 square blocks of a residential neighborhood. This was constructed at a saving of from \$4000 to \$5000 to taxpayers. And an old mill race that cut through another residential section has been filled.

"We worked within 50 feet of residences, but people didn't mind," Fagerlind said. "They felt that while the fill was going in, it was no worse than looking at the gaping 100- to 150-foot trench that sliced through their properties. They thought of the increased property value that would result when the job was finished."

Compaction, Fagerlind feels, is the key to successful landfill. It is necessary to have a good heavy tractor that will crush cartons, tin cans and bottles and thoroughly tamp the refuse before the cover is put on. This eliminates the vermin and reduces the degree of future settling of the land.

Work horse in Waterloo's sanitary landfill program is a CAT\* D7 Tractor with No. 7S Bulldozer. Says Fagerlind: "Its cost of operation is very, very low and it does a wonderful job. We had over 4000 hours on it before any major expense was met. And very important, it has the weight for proper sanitary landfill."

Practical information on sanitary landfill, as well as the function of Caterpillar-built equipment in the method, is available from your nearby Caterpillar Dealer. A phone call, card or letter to him will get prompt attention.



Under the landfill method, land can be reclaimed close to homes, increasing property values. The refuse is covered each night under a compacted blanket of earth, so rats and flies can't breed in it and it can't burn.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS, U. S. A. \*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

# Trickling Filters at FORT WORTH, TEXAS use

# TFF

In Fort Worth rapid growth of the city produces fresh problems in sewerage and wastes treatment almost daily. To anticipate them and be prepared to meet them trickling filters were chosen as the best possible combination of efficiency and flexibility.

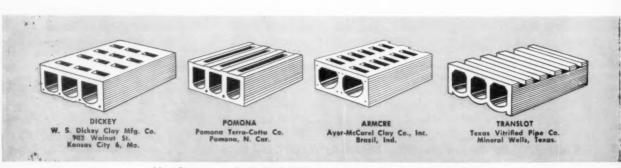
# because

Advantages of flexibility include the fact that the essentials are the same for low rate or high rate filters, for large volume or small. A basic, properly designed trickling plant such as Fort Worth's is capable of meeting all requirements—present and future—within foreseeable limits. Plus these other desirable features: ability to handle overloads, expansion, simplicity and reliability of operation, long life, low costs, durability and good results.

# TFFI SPECIFICATIONS

For underdrains are contained in pages 37 and 38 of the new TRICKLING FILTER HANDBOOK, under "Standard Specifications for Vitrified Clay Filter Blocks for Trickling Filters." Available from any TFFI member.

# TRICKLING FILTER



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noto shows TFFI specification blocks in new Fort Worth trickling filters.

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## BOOKS IN BRIEF

# GUIDEBOOK TO HELP WITH

This "Urban Development Guidebook" explains how to meet the critical city problems of congestion, blight and failure to use tax resources. It was developed largely from material obtained in urban development conferences sponsored by chambers of commerce in six cities with outstanding development programs. The conferences made clear the need for an over-all approach to problems of community growth and changes and they recommend establishment of local urban development teams which include representatives of all segments of society. The book may be obtained from the Chamber of Commerce of the United States, Washington 6, D. C. Price is \$1 per copy.

# MANUAL FOR ENGINEERS AND LAND SURVEYORS

This pamphlet, entitled "Restoration of Lost or Obliterated Corners and Subdivision of Sections," is prepared especially for the information and guidance of engineers and surveyors. The explanation of the methods found by experience to be generally successful in the retracement of the lines of the public land surveys and recovery of evidence of the corners and other marks of those surveys has been fully covered. Also, a section on the subject of meander lines and riparian rights is included. Price is 20¢ per copy from the United States Dept. of the Interior, Bureau of Land Management, Washington 25. D. C.

#### FINANCING OF HIGHWAYS

This report, "The Financing of Highways by Counties and Local Rural Governments, 1942-51," is the second publication resulting from an extensive long-term study by the Bureau of Public Roads. The report presents a discussion, and detailed statistical data, concerning the financing of highways by the county and local rural governments during the 10 year period 1942-51. Included

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With an M-B Packer on the route, every stop counts! No call-backs for bulky, awkward items left behind by ordinary packers. Material too large for the extra-wide side loading doors is carried easily on the spacious, reinforced roof. M-B Packers cover bonus blocks of collection!

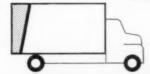
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Collectors don't waste valuable time sorting refuse for vulnerable hydraulic packing mechanisms. M-B Packers take all types of material—cardboard boxes, wet garbage, wooden boxes and crates, large drums, old tires, powdery ashes—anything and everything! The rugged, winch-operated packing plate can stand the roughest punishment.

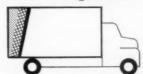
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Cardboard, wooden and metal containers are tossed right in the body without pre-crushing. Traveling bulkhead packer plate exerts tremendous crushing force at three points — top and two lower corners — to assure full use of engine power for complete compaction.

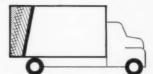
# POWERFUL PROGRESSIVE COMPACTION handles all "hard-to-pack" loads



During first packing cycle material is compacted under force of about 1,000 lbs. per sq. ft.



Loadings for second cycle are compacted under same force while first load receives another thorough compaction.



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# This 1000-foot bridge now stays open to traffic

The picture has changed. It frequently read "Closed to Traffic" while maintenance crews worked to patch up worn plank flooring. Then over a year ago U.S.F. Structural Plate Bridge Flooring and a bituminous surface was installed. Since that time the bridge has been in constant use, and still looks and serves like new despite heavy traffic from a nearby giant Atomic Project.

USF Bridge Flooring is serving on bridges up to 1000' long and on one 425' wide. It will pay you to investigate.



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Ken Smith Machinery Co., Inc. Albany, H. Y.

Thompson Pipe & Steel Co. Denver Colo

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F. Yeager Bridge & Culvert Co. Port Huron, Mich

Young & Greenawalt Co. East Chicago, Ind.

George R. Workman Co. Frankfort, Ky.

is information for each year, by states, on county and local receipts, expenditures and debt for rural highways. Comparisons with earlier years are included in the summary tables and charts. Price 75¢: 110 pages. Copies from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C.

#### CLAMSHELL BUCKETS

'Maintenance and Care" of Clamshell Buckets is the title of Bulletin 2373-R published by Blaw-Knox Co. It contains 40 pages of illustrations and carefully indexed information including: How to use counterweights for maximum efficiency; when to increase or decrease bucket reeving; what makes bucket lips bend in or bow out; repairing fractures; and numerous other items, such as a list of common abuses leading to early bucket failure and proper lubrication practices. Copies free from Bucket Department, Blaw-Knox Co., Pittsburgh 38, Pa.

#### SUPER REFRACTORIES FOR INCINERATORS

This 60-page catalog deals with the product properties of super refractories useful in incinerators. Included is information on stoking door and charging door linings and users, sidewall and ash pit linings and users and joint packing. Copies free from the Carborundum Co., Refractories Division, Perth Amboy, New Jersey.

#### CONSTRUCTION OF HOUSING-ESTATE ROADS

This publication is designed to help engineers in the preparation of specifications for housing-estate roads of flexible construction. It deals with the properties of granular base and sub-base materials and seeks to encourage the use of relatively small-sized materials; these can be laid quickly and cheaply by machine in thin layers. The use of the California bearing ratio method of determining the thickness to use is recommended. Design curves are included for the classes of traffic likely to be encountered on housing estates and in large development areas. Request Road Note No. 20-"Construction of Housing-Estate Roads Using Granular Base and Sub-Base Materials," from the Dept. of Scientific & Industrial Research, Charles House, 5-11 Regent Street, London S.W.1, England. Price is 1s. Od. (18 cents U.S.A.) by post 1s. 11/2d.

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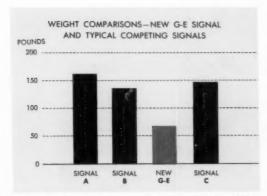
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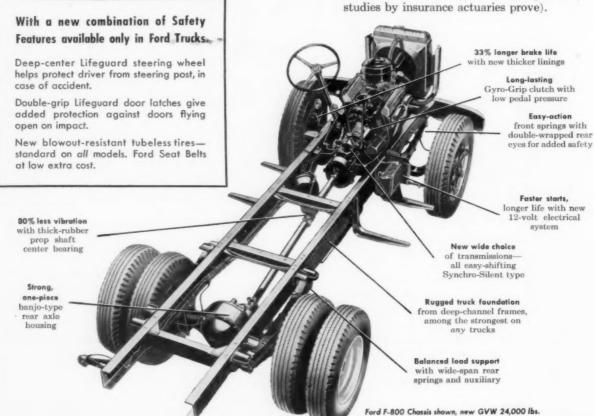
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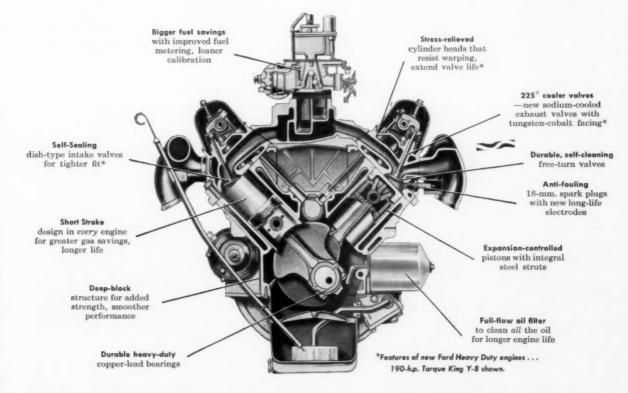
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#### PUBLIC WORKS PROGRAM

#### **NEW LISTINGS**

#### Highway Engineers Get Information On An Aggregate and Material Dryer

172. This bulletin contains specifications, illustrations and design of the "Tarco" sand, stone and gravel dryer. Heating and drying capacity is fully covered along with attachments and modifications. Get your copy from Tarrant Mgs. Co., Saratoga Springs, N. Y., or check the handy coupon.

#### A Catalog on Complete Line of Fittings for Wire Rope and Chain

of Fittings for Wife Kope and Chain

199. A new 28-page catalog on a complete
line of fittings for wire rope and chain has
just been issued by the Thomas Laughlin Div.,
Portland, Maine. It includes engineering data
and charts, pictures, dimensions and safety
factors for links, rings, shackles, swivels, hooks,
eyes and load binders and many types of
fittings. Check the coupon for your copy.

#### Valuable Booklet on Ice Skating Rinks

237. Piping and floor design and construction and refrigeration equipment are a few of the items covered in this bulletin. There are plenty of graphs, charts and design problems included. For your copy send to E. R. Carpenter, 1560 Ansel Rd., Cleveland 6, Ohio, or circle the common common construction.

#### "A Complete Package" of Road Building Equipment

261. A new catalog describing the road widener, trench roller and base paver has just been released by Blaw-Knox Co., Blaw-Knox Equipment Division, Pittsburgh 38, Pa. Illustrations, specifications and operation procedures are fully covered. Also, other types of construction equipment are mentioned. Check the coupon today.

#### Catalog Available on Malsbary Steam Cleaner

445. A new catalog describing and picturing the entire Malsbary steam cleaner line has just been released by Malsbary Mfg. Co., 845 92nd Ave., Oakland 3, Calif. Included is an easy-to-read chart of cleaning actions, pressured, temperatures and capacities and suggestions where each model can be used. Check the coupon today.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the coupon, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field.

#### Valuable Bulletin on Pipe Cutters

454. An informative new bulletin covering the application of manually operated cutters to field cutting of asbestos-cement pipe has been issued by Pilot Mig. Co., 3970 Pacific Coast Highway, Torrance, Calif. It contains data and illustrations on cutter sizes and models. Check the coupon for your copy today.

#### A Manual

#### on Tandem and 3-Wheel Rollers



449. This man-ual covers everything on the variable weight, 5-8, 8-10, 8-12 and 10-14 ton tandem roll-ers and on the stand-ard and variable ers and on the standard and variable weight, 8, 10, 12, 14 ton and 8-10, 10-12, 12-14 ton 3-wheel rollers. Covered are the frame, transmission, final drive, front end and operator's controls. The design, construction, performance, transmission, performance of the standard operator's controls.

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trols. The design, construction, performance and service of the rollers are fully plenty of illustrations are fully many of illustrations for each roller model. Available from Huber-Warco Co., Marion, Ohio, or check the handy coupon.

#### How to Make lcy Surfaces Safe

455. A bulletin on how calcium chloride works in ice control and directions for its use has been made available by Wyandotte Chemicals Corp., Wyandotte, Michigan. Other uses of calcium chloride are fully outlined. Check the councer.

AND

#### Pressure Treating Structural Wood With Chemical Preservatives

446. How pressure treating structural wood with chemical preservatives add to its life, lowers its cost by reducing annual maintenance and replacement costs is fully described in catalog just released by J. H. Baxter & Co., 120 Montgomery St., San Francisco 4, Calif. Bridges, water towers, railroads, guard rail posts and piling are some of the uses of the treated wood. Check the coupon today.

#### Literature on Protective and Decorative Coatings For All Masonry Surfaces

447. Silicone formulations, protective and decorative coatings for the control of water scepage and dampness are fully described and illustrated in literature available from Siliphane Corp. of America, 10 East 40th St., New York 16, N. Y. These coatings can be used above or below grade and binds chemically and mechanically to the surface to which it is applied for maximum durability. Check the handy coupon today.

#### What You Should Know About the Rubber Waterstop

486. A bulletin on the Servicised rubber waterstop has just been released by Servicised Products Corp., 6051 West 65th St., Chicago 38, Ill. General information, engineering service, advantages of specifying the waterstop, specifications, general and detailed requirements, installation and typical applications, standard sizes and types are fully covered. Check the coupon for your copy.

#### MORE LISTINGS ON PAGES 34 TO 48

#### Steel Pipes For Wherever Water Flows

452. A very good catalog, entitled "Whenever Water Flows Steel Pipes It Best," on the history of steel pipe, steef pipe installations and how steel pipe is manufactured is available from The Steel Plate Fabricators Assn., 79 W. Monroe St., Chicago 3, Ill. Advantages of steel pipe, ductility and adaptability, installation advantages of steel pipe, field joints and protective linings and coatings are fully covered. Check the coupon today.

#### Welded Steel Pipe

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456. A new bulletin that describes and illustrates the advantages of welded steel pipe for piping, water supply, sewage disposal and foundation piling is available from Armaco Drainage & Metal Products, Inc., Middletown, Ohio. Eleven advantages are listed and dimensional data and properties are given along with data on pressure design. Check the coupon for WSP-11055.

#### Mapping By Use of

Aerial Photography and Photogrammetry

457. Mapping by use of aerial photography and photogrammetry and the equipment used in this work are explained and illustrated in the 8 page catalog "Serving the Engineering Profescoupon.

#### USE THIS COUPON to get detailed information

on products and materials mentioned in this issue. Circle numbers below and mail today.

#### Booklets from pages 40 to 56:

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#### 394 397 398 404 422 426 438 442 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468

#### New Products, pages 164 to 169:

2-1 2-2 2-3 2-4 2-5 2-6 2-7 2-8 2-9 2-10 2-11 2-12 2-13 2-14 2-15 2-16

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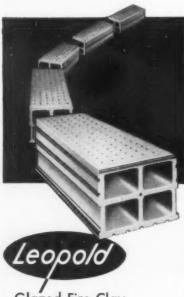
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#### **NEW LISTINGS (Cont.)**

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#### Bulletin on Unitube Tow-Bro Sludge Remover

451. The Unitube Tow-Bro sludge remover is fully described in a bulletin just released by Chain Belt Co., Milwaukee I, Wisc. Advantages and performances are covered along with different design methods. There are good photographs and sketches of the sludge remover in operation. Check the coupon today.

#### New Catalog on Flexible Compression Fittings

453. This 12-page catalog, well illustrated both by photographs and drawings, highlights the use of these fittings on steel piping and copper tubing. Illustrations taken from case histories and featured throughout the catalog, will be of special interest to equipment designers and piping engineers. Get your copy from Dresser Mfg. Div., Bradford, Pa., or check the handy coupon.

#### Information on Self-Propelled Road Sweepers and Tow Sweepers

458. Literature has just been released on the only self-propelled road sweeper on the market and tow sweepers by Little Giant Products, Inc., 1533 North Adams St., Peorgia, Illinois. Prices, detailed specifications and typical jobs where the sweepers can be used are fully covered. Check the coupon today.

#### How A Diatomite Filter Works

466. The three main steps in diatomite filter operation—precoating, filtering and cleaning are discussed and clearly illustrated with specially prepared drawings in Bulletin No. 5502 of the General Filter Co., Box 11, Ames, Iowa. Get this interesting bulletin by checking the coupon.

#### How to Select Paints For Every Maintenance Need

467. Selecting the right paint for each maintenance need involves consideration of the service to be rendered, conditions of their use and abuse, and the surfaces to which they are to be applied. To help you determine what to use on various surfaces, an industrial paint index printed in the form of a handy file folder has been prepared by the Tropical Paint and Oil Co., Cleveland 2, Ohio. Get a copy by checking the coupon.

#### A Guide to Effective Traffic Safety

468. A 20-year catalog with hundreds of illustrations of all types of signs used on highways and in motor and pedestrian traffic areas is offered to public works officials by Traffic and Street Sign Co., 84 Foundry St., Newark 5, N.J. This convenient reference covers all your sign needs. For your copy check the coupon today.

#### Complete Information on Wain-Roy Back Hoe

459. Complete information on a complete self-contained back hoe that is designed to fit Payloader tractor-shovels and International crawler tractors is available from Wain-Roy Corp., Dept C, Hubbardston, Mass. Included are specifications, types and many exclusive features. Check the coupon today.

#### Advantages Offered by Aluminum Building Products

460. Strong, light-weight aluminum sheets and extruded sections offer many advantages on public works structures, including weight savings, corrosion resistance, reduced maintenance

and attractive appearance. Applications range from roofs and walls to air conditioning and heating duct systems. For names of building products manufacturers who will work with you write Kaiser Aluminum and Chemical Sales, Inc., Kaiser Building, Oakland 12, California, or check the handy coupon.

#### The Trucks You Need for Every Public Works Job

461. Extra life and operating economies are built-in features of every Ford truck model. There's a chassis size and engine for each of your needs, from light utility work to heavy-duty construction jobs. Get latest literature from Ford Motor Co., Truck Div., Dearborn, Mich., by checking the coupon.

#### Get Data on Automatic Engine Control Equipment

462. Automatic controls for engine starting and overspeed protection are described in the latest Synchro-Start literature. For full application data and specifications get Catalog No. 5 from Synchro-Start Products, Inc., 8151 N. Ridgeway Ave., Skokie, Ill. Check the coupon today.

#### Important Factors in Water Meter Selection

463. Interchangeability of parts is an important advantage that is yours when you use Trident meters. The newest parts fit your oldest Tridents so you modernize when you repair. Get full data on the entire Trident water meter line by checking the coupon or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

#### Literature Available on Wagner Tractor Equipment

464. Information on the Wagner back hoe and loader is available from Wagner Iron Works, Dept. 129, 1905 South First St., Milwaukee 1, Wisc. Specifications, types, models and other valuable data are included. For your copy check the coupon.

#### Data on Adjustable-Speed Magnetic Drives for Low-Lift Pumps

465. A catalog is available from Electric Machinery Mfg. Co., Minneapolis 13, Minn. that tells all about E-M Vertical Synchronous Motors and Magnetic Drive Units. Engineers check the handy coupon for information on this equipment for sewage pumps.

# CONSTRUCTION EQUIPMENT AND MATERIALS

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35. At today's prices, hand digging means the job will be coatly. You can dig through asphalt and macadam, work fast and efficiently even in cramped areas with the tractor mounted Sherman Power Digger. From one position you can reach to dig 14 feet behind tractor in 140° arc and dig to a depth of 10 feet. For full details check the coupon. Sherman Products, Inc., Royal Oak, Mich.

#### Data Offered on Highway Drainage Products

57. Engineering data on corrugated metal culverts and pipe arch highway drainage structures are contained in bulletins of United Steel Fabricators, Wooster, Ohio, Just check the coupon—information on these fabricated steel products will be sent to you promptly.

#### Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit Netco Div., Clarke-Wilcox Co., 118 Western Ave., Boston 34, Mass.



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#### "Encyclopedia" on Bulldozers

97. Every size and style of bulldozer made by Caterpillar Tractor Co., Peoria 8, Ill., is shown in a 36-page booklet, Form 30461. Cutaway views showing details, important components of hydraulic and cable controls, attachments such as brush, root and rock rakes, treedozers and stumpers are also included. Get this interesting publication by checking the coupon.

#### Streamlined Data on Tractors, Scrapers and Power Units

102. The complete line of International Industrial Power products, 73 in all, is described in a new 48-page catalog just published by International Harvester Co., 180 N. Michigan Ave., Chicago I, Ill. Technical data has been streamlined, yet provides abundant descriptive material on each piece of equipment. Check the coupon for the latest on crawler and wheel tractors, scrapers, dozers and related atachments plus International Diesel, gasoline and gas power units.

#### Heavy-Duty Pipe Cutter Works In or Out of Trench

164. Built to stand the most severe service, the all-purpose Ellis & Ford pipe cutter, for cast iron water mains 4" through 12", is easy to use in tight places, works in or out of trench. Full details on cutter and interchangeable parts in Catalog 39, available by checking coupon. Ellis & Ford Mfg. Co., Ferndale 20, Mich.

#### Information on "Bondactors" Concrete Gunning Machines

Concrete Gunning Machines

282. The "Bondactors" are concrete gunning machines that are capable of gunning cementitious aggregates by means of compressed air at a greater density, stronger bond and longer-lasting surface. Full details on models, specifications, accessories and extra accessories are included. Examples of these machines being used for waterproofing, concrete restoration, stuccoing, building cleaning and fireproofing are shown. For your literature send to Air Placement Equipment Co., 1009 W. 24th St., Kansas City 8, Mo., or check the handy coupon.

#### Diesel Power for Wheel Tractor-Loader Units

151. All the advantages and economies of discel power are provided in tractor-loader units of Minneapolis-Moline, Minneapolis 1, Minn. Get latest information on wheel tractors and loaders by checking the coupon. It will help you select units to fit your needs.

#### Now Every Municipality Can Own a Trencher

173. The low cost of the Blackhawk Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 8 feet deep 20 inches wide. Illustrated bulletin available from Arps Corp.. New Holstein, Wis. Just check the coupon.

#### A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 10, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air. For full details check the coupon.

#### The Modern Approach to the Brush Problem

222. Eliminate your brush disposal problem by using an Asplundh Chipper. For complete information on what the Chipper can do, how it can save on costs, various types available and other outstanding features write to Asplundh Chipper Co., 505 York Road, Jenkintown, Pa., or check the coupon

#### Helpful Data

#### On Pipe Tools

230. Toledo drop head ratchet threaders are light, compact, ideally suited for work in tight corners. Three models for 45" to 44", 45" to 14", and 45" to 2" pipe all feature quick change of sizes. Get Catalog No. 25 from Toledo Pipe Threading Machine Co., Toledo Ohio. Check the coupon.

#### Complete Protection Of Iron and Steel Products

242. What are the advantages of Hot-Dip Galvanizing? Why does it offer complete protection at such an economical voil in find the answers in the attractive booklet "Stop Rust", which gives you the fall story of the process plus a comprehensive coating major in the coupon or write American Hot-Dip Galvanizers Assn., Inc., 1st National Bank Bldg., Pittsburgh 22, Pa.

#### Here's Help for Laboratory Planning

369. A comprehensive laboratory planning guide that tells the engineer and designer how to obtain maximum space economy; utilize new and present facilities; and use functional design in locating utilities, ventilation and lighting is now available from Metalab Equipment Corp., Hicksville, L. L., N. Y. Complete data includes sectional and interchangeable lab equipment, furniture and accessories. Check the coupon for this valuable planning aid.

#### Economical Scraper Handles Many Heavy Jobs

398. Among the many applications of the versatile Model D Tournapull are: grading and building roads; handling garbage disposal, and grading, leveling and terracing. For details on how its speed, power and ability to work either as a self-loading tool can help your production and lower your costs, write Le Tourneau-Westinghouse Co., Peoria, Ill., or check the coupon.

#### Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Full data on these ditchers available by checking the coupon.

# SPEED SENSITIVE Switches



Synchro-Start units are available in two body designs for one, two and three switches. The GS series is for a standard distributor take-off with gear or coupling drive and has oilless bronze bushings. The GH body is for standard SAE tachometer drive and runs in oil sealed ball bearings.

These units contain two snap action switches rated at 10 Amps.-110 Volts A.C. and can be used for either opening

or closing circuits at any RPM over 350. Each switch is individually adjustable up to 2000 RPM above specified set speed.

The models shown here are designed for a two speed operation such as cutting out a starting motor circuit and providing overspeed protection with manual or automatic re-set. The dust cap is available with open terminals or a variety of standard or special connector fittings.



SYNCHRO-START PRODUCTS, INC.

- fulamata Engine Control Equipment
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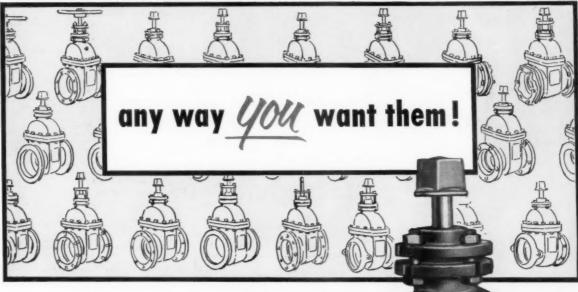
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#### SEWERAGE AND WASTE TREATMENT

#### What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the coupon and we will torward your request.

#### How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe is not of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams. Mass.

#### A Handbook of Sewer Cleaning Methods and Materials

44. Complete, easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible, Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included. Check the coupon for your copy of this helpful handbook.

#### Helpful Design Data For Sewage Ejectors

81. The application and advantages of pneumatic sewage ejectors are outlined in a new bulletin of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems. Get your copy by checking cou-

#### Packaged Sewage Treatment-Just Right for Small Places

36. "Package" Sewage Treatment Plants specifically developed for small communities—100 to 3,000 pepulation. Write for full description and actual operating data for this type of plant. Chicago Pump Co., Dept. J, 622 Diversey Pkwy, Chicago 14, 1ll.

#### Removing Grit From Sewage and Trade Wastes

80. The 20-page bulletin on the modern method for removing grit published by The Dorr-Oliver Company, Barry Place, Stamford, Conn., provides detailed description of the design and operation of The Dorr Detritor. Pertinent facts concerning the types, special designs, advantages, principle of design are included. Check the coupon for your copy of Bulletin #6411.

#### Machanical Joint Principle Applied to Sewer Pipe

101. The Amvit joint forms a tight compression seal between bell and spigot rings, prevents infiltration and stops root intrusion. Get data on Amvit jointed vitrified clay pipe from American Vitrified Products Co., Cleveland, Ohio.

#### Valuable Information On Permutit's Precipitator

108. A well illustrated 20-page Bulletin, No. 2204 C, describing the many applications, principles of operations design features, advantages, recommendations, flow diagrams and specific services of the principles of the services of the se

#### Spiraflo Clarifier

124. Be sure to investigate the advantages of the Spiraflo clarifier for sewage treatment. Full engineering data, description of the unit, test results and specifications are offered in 24-page Bulletin 122 by Lakeside Engineering Corp., 222 W. Adams St., Chicago, IU. Check the coupon today.

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Gar Wood Winches

#### To order these helpful booklets check the coupon on page 40.

#### Data Offered on Water, Sewage and Waste Treatment Equipment

263. Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Colmar, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Tritor screens, flash mixers, scum breakers and other units are described. Check the coupon for your copy.

#### Dependable Engines For Sewage Treatment Plants

227. Climax Sewage Gas Engines are available for continuous duty operation to drive pumps, blowers or generators in a range of sizes from 40 to 250 HP. Use the handy coupon to obtain complete details and literature from Climax Engine & Pump Mfg. Co., 208 S. LaSalle St., Chicago 4, III.

#### A Pressure Proven Joint for Concerte Pipe

335. Investigate the Amseal Joint on low pressure concrete pipe for intercepting sewers, inverted syphons, sewage force mains and low pressure water supply lines. This folder is published by American-Marietta Company, Concrete Products Division, 101 East Ontario St. Chicago II, Illinois. Describes concrete pipe for use in sewer and water lines where maximum operating pressure will not exceed 50 psi. Check the coupon today.

#### Engineering Data on Gas Safety Equipment

343. P.F.T. Gas Safety Equipment for Controlled Digestion is the subject of an excellent 12-page bulletin issued by Pacific Flush Tank Co., Chicago 13, Ill. Full engineering data on fame traps, pressure releases, waste gas burners and related equipment is provided in convenient form. Requests for this valuable booklet must be made on business letterhead.

#### Efficient Underdrains for Rapid Sand Filters

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#### Submersible Sewage Ejector Simplifies Installation

275. The Weil submersible non-clog sewage ejector is a compact unit with a completely sealed motor, available in several sizes with capacities up to 300 gpm. For details on unit selection, installation methods, construction features and controls get Bulletin SE-660A from Weil Fump Co., 1550 No. Fremont St., Chicago 22, Ill. Check the coupon.

#### Shredders and Grinders For Efficient Sewage Treatment

346. Latest data on screenings shredder, garbage grinder and dry sludge shredder are presented in Bulletin SG10 by Gruendler Crusher & Pulverizer Co., 2915 North Market St., St. Louis 6, Mo. Dimension and capacity charts are provided, together with drawings and photographs of the grinders and screens. Check the coupon.

#### Combat Unpleasant Odors At Municipal Sanitation Sites

404. Malodors at municipal refuse disposal sites, waste treatment plants and incinerators may, be effectively "neutralized" by the odor masking products of Rhodia, Inc. Be sure to investigate this means of eliminating complaints from unpleasant odors. Write Rhodia, Inc., 230 Park Ave., New York 17, N. Y. or check the coupon.

# REFUSE COLLECTION AND DISPOSAL

#### Sanitary Landfill Operation and Methods

28. The location and area requirements for sanitary landfill, operation methods for trench type and area fills, equipment selection and costs are items discussed in an 8-page booklet issued by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. Be sure you have this reference when considering the problem of garbage and refuse disposal. Check the handy coupon today.

#### New M-B Packer Body Designed for Maximum Payload

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#### How to Construct A Sanitary Fill

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#### Check These New Features On Refuse Collection Bodies

Asa. The all-new Heil "Collectomatic" refuse collection unit incorporates the best features suggested by municipal operating crews, supervisors and private operators to provide easy loading, simple operating mechanism, bulldozer type packing, fast dumping and many other important advantages. Check them all by getting attractive Bulletin BH-54103 from The Heil Co., 3044 W. Montana St., Milwaukee I, Wis. Your copy is ready—just check the coupon.



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#### Easy Reference on Durable Gratings and Treads

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#### Useful Attachments for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "'," and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc. Check the coupon today and full details will be sent.

#### How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. PW, Warren, Ohio.

#### Trenching Equipment Data Conveniently Assembled

212. The entire line of Cleveland trenching and backfilling equipment is now covered in a single bulletin, with material arranged for quick comparison of capacities, specifications and dimensions of all models. Twenty-four action photos graphically illustrate various job applications. Get Bulletin S-120 now for easy review of your trenching equipment needs. Just check the coupon or write to the Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

#### Give Full Protection To Treated Poles and Timbers

267. Bolt holes in treated poles and timbers used for guard rails and structures can easily be the first point of decay. Now you can assure maximum life by using the Greenlee Bolt Hole Treater, a simple device that forces preservative into the wood cells. Bulletin 13-15 gives the details. Greenlee Bros. & Co., Rockford, Ill.

#### How to Solve the Brush Disposal Problem

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#### How the Mobil-Sweeper Can Improve Street Sweeping

305. Sweeping costs can be cut with the Mobil-Sweeper which features safe highway speeds up to 55 mph, carrier 2 2/3 cu. yd. dirt hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to the Conveyor Co. 3260 E. Slauson Ave, Los Angeles 58, Calif. or use coupon for complete details on this machine.

#### Go-Anywhere Transportation Provided by the "Jeep" Family

377. A new booklet which graphically portrays the wide range of uses of "Jeep" vehicles in public service is now available from Willys Motors, Inc., Toledo I, Ohio. Specifications, special equipment, accessories and plenty of photographs of the jeep in action are included. Just check the coupon for your copy.

#### Information on Trucks for Every Job

442. Literature on the world's most complete truck line is available from International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill. Included is information on basic models, conventional and COF, 4-wheel, 6-wheel and four-wheel-drive. Check the coupon.

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#### WEED CONTROL

#### Weed Killing Case Histories

205. Weed and grass control lasts longer ... costs less with Du Pont "Telvar" weed killers. Interesting folder published by Grasselli Chemicals Dept. E. I. Du Pont de Nemours & Co., Inc., Wilmington 98, Del. Full color photographs demonstrate effective action; text shows application methods for best results. Check the coupon for your copy.

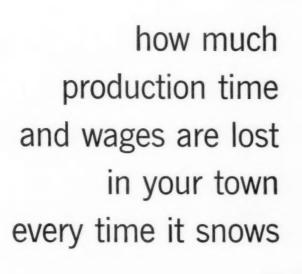
#### Powerful Mist Sprayer Controls Pests

241. Mist sprayers for shade tree and mosquito control, roadside weed control sprayers and a full line of pressure pumps, engine equipment and spray guns in assemblies for every spraying need are presented in an illustrated catalog by Hardie Mfg. Co., Hudson, Mich. Get 40-page Catalog No. PC 57 for data on all types of chemical spray and dust equipment. Check the coupon.

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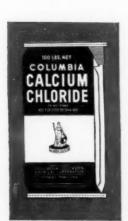
#### Reliable Estimates of Smoke Density

85. The Smokescope, product of Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa., offers a reliable method for estimating smoke density. This data is the first requirement of an effective program for air pollution control. Find out how easy it is to take smoke density readings. Check the coupon for Smokescope data.





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#### Data on Cutting-In Valves, Repair Sleeves and Accessories

23. A variety of Clow products for installation and repair of cast iron pipe lines, including the Eddy cutting-in valve and sleeve, split sleeves for pipe repair, test plugs, valve boxes, Strickler pipe cutters and other fitting and accessories are featured in literature available from James B. Clow & Sons, Inc., Box 6600-A, Chicago 80, Ill. Check the coupon.

#### Engineering Information and Water Distribution Products

49. Helpful engineering information, covering water distribution problems, is available from Mueller Company in their W-96 Water Works Catalog. The 328 page catalog features a quick reference sectional indexing arrangement for easy location and identification of the hundreds of water distribution and service products illustrated. Check the coupon and you will receive detailed information on a complete line of water works equipment.

#### What You Should Know About the Centriline Process

197. The Centriline method for cement mortar lining water mains in place to stop leaks, prevent corrosion and increase carrying capacity is fully described in a handsome booklet issued by the Centriline Corp., 140 Cedar Street, New York 6, N. Y. Many illustrations and typical case histories show the operation and conomies of this process and its application in the rehabilitation of old pipelines which had been operating at less than new pipe value prior to cleaning and lining. Check coupon for your copy. copy.

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With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal, control of certain tastes and odors, plus other aids in high quality water production. Check coupon for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

#### Helpful Booklet on Carryable

Centrifugal Pumps

129. A booklet prepared to give practical information that will guide you in choosing the best type of pump for your requirements is offered by the Homelite Corp. Both gasoline and electric models are discussed, and requirements outlined for many applications. Just check the coupon for your copy. The Homelite Corp., 2125 Riverdale Ave., Port Chester, N. Y.

#### Purification of

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153. An up-to-date 64-page manual on purification of swimming pool waters presents a comprehensive discussion of daily requirements, chlorine residuals and feeding methods for hypochlorites and HTH tablets. Available from Industrial Chemicals Div., Olin Mathieson Chemical Corp., Baltimore 3, Md. by checking the coupon.

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Various Municipal Uses

Various Municipal Uses
137. A booklet on calcium chloride discussing its use in dust and ice control, dehumidification, refrigeration brine, concrete curing, dust-proofing coal and surface consolidation
is available from Columbia-Southern Chemical
Corporation, One Gateway Center, Pittsburgh
22, Pa. Photographs and tables are included.
Check the handy coupon.

#### What You Should Know

About Turbine Pumps

167. In a colorful bulletin titled "Water Where You Want It.". When You Want It" the Johnston Pump Co., Bin "K", Pasadena 8, Calif., gives details on turbine pumps with semi-open or closed impellers; oil or water lubrication; and adaptations for any power source or combination thereof. Get your copy of Bulletin 1015 by checking the coupon.

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#### Engineering Data on

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196. The Chapman tilting disc check valve is designed to lift away from the body seat without sliding or wearing; closes without slamming. Operating principles, details of construction, dimensions, recommendations and engineering data are fully covered in 18-page Bulletin No. 30. Get your copy by checking the coupon or write to Chapman Valve Mfg. Co., Indian Orchard, Mass.

#### Complete Catalog and Reference Date

on Valves and Fittings
211. The entire M & H line of valves, fittings and accessories for water works, filtration sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Annisten, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the coupon.

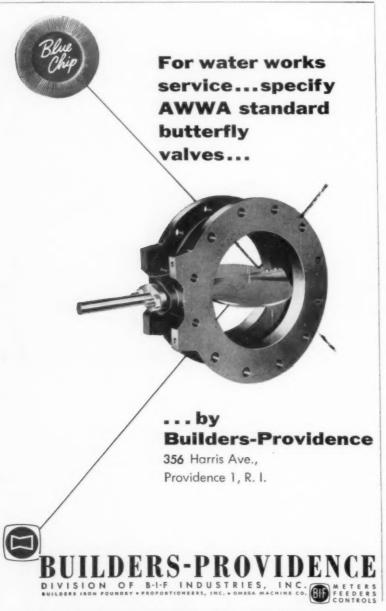
#### Helpful Valve Catalog

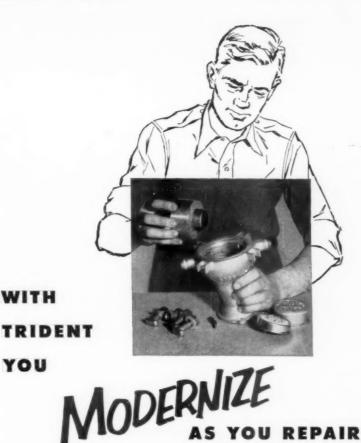
For Engineers

236. For complete descriptions of Darling double disc, parallel seat gate valves be sure to get Bulletin 5403 issued by Darling Valve & Mfg. Co., Williamsport, Pa. Construction details covering all valve parts and accessories are helpful for specification writers. Check the coupon for your copy.

#### Explaining the Water Diaphragm

Principle of Chlorinator Operation
243. The features, operation and benefits of the water disphragm principle of chlorinator operation are fully described and illustrated in Publication TA-1026-C-1 recently published by Wallace & Tiernan Inc., Belleville 9, N. J. This helpful publication is yours for merely checking the coupon.





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#### Standard Specifications

for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in convenient booklets offered with the compliments of U. S. Pipe and Foundry Co. Birmingham 2, Ala. Get your copy by checking

#### Technical Bulletin on Solenoid Operated Valves

288. Full technical data on application, construction, dimensions and specifications of Golden-Anderson Cushioned solenoid operated valves is contained in Bulletin W-7A, available from Golden-Anderson Valve Specialty Co. 1232 Ridge Ave., Pittsburgh, Pa. Selected valve patterns are offered in ½ to 2-in. and 2½ to 36-in. sizes. Get all the details; just check the

#### Instrumentation and Control

**Equipment For Water and Sewage Plants** 

298. Full engineering data on the instrumentation and control equipment needed in water works, sewage plants, pumping station and related installations are provided in the "Application Engineering Data" binder issued by the Foxboro Co., Foxboro, Mass. Every engineer and designer should have this valuable material on hand. Check the coupon if you can use this data.

#### Get the Facts on

#### The Contact Aeration Process

303. Full engineering details on the submerged contact aeration process of sewage treatment, including diagrams of plant units, area requirements, operating costs and other details are available in a bulletin of the Hays Process Co., Box 768, Waco, Texas. Check the coupon to get the facts.

#### Helpful Data on

Swimming Pools

364. Data on injector nozzles for complete recirculation, fittings for correct drainage and other useful information for pool design are covered in Manual SP issued by Josam Mfg. Co., Michigan City, Ind. Check coupon for Co., Mich your copy.

#### Modern Filtration of Swimming Pool Water

351. Latest data on filtration systems for awimming pools of 50,000 gallon capacity and over is presented in 24-page bulletin No. 625 R. P. Adams Co., Inc., 225 East Park Drive, Buffalo 17, N. Y. Design and operating data are provided, together with material to assist you in choosing the right filter for your pool. Check the coupon for your copy of this helpful bulletin.

#### Are You Ready Now To Make Main Repairs?

214. Broken water main can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Leaky bell and spigot joints are made lastingly tight with Skinner-Seal Bell Joint Clamps. Get Skinner Catalog GW now—this handsome 48-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. Just check the handy coupon for your copy.

#### Helpful Data on Water Meters

330. It is to the interest of every water 330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mig. Co., Milwaukee 45, Wis. Check the coupon for your copy.

#### Points to Consider in Filter Sand Selection

332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa. Get full details by checking the

#### Rapid Sand and

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109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.

Data Offered on **Elevated Steel Tanks** 

166. Attractive designs for elevated steel water storage tanks are shown in bulletins of R. D. Cole Mfg. Co., Newman, Georgia. For copies of latest Cole literature check the handy

#### Valuable Information

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356. This helpful booklet describes the design, uses and advantages of prestressed concrete in all types of storage tanks. Plenty of charts, diagrams and illustrations are included. Get yours from Preload Enterprises, Inc., 211
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#### Restoration and Protection Of Concrete Structures

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#### Informative Data on Plating Waste Treatment

on Plating Waste Troatment
394. This reprint, entitled "Plating Waste
Solutions—Recovery or Disposal," discusses the
two possible methods of treating plating wastes
by ion exchange or precipitation. Included are
details of the coats involved, space requirements
and illustrations showing typical plants and details of equipment. Available from Graver Water Conditioning Company, 216 West 14th
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#### Valuable Booklet on Porous Diffuser Plates and Tubes

341. A helpful 16-page booklet published by the Norton Co. is a complete guide for the selection of porous media for installation in rapid sand filters and activated sludge plants. Full data are provided for the consulting engineer. Maintenance of porous media is also discussed at some length. Get Form 1246 from Norton Ce., Worcester 6, Mass. by checking the coupon.

#### Dependable Standby Power For Water Pumping

342. The use of LeRoi generator sets for dependable low-cost standby power is discussed in an attractive bulletin, No. G-6, issued by LeRoi Div. Westinghouse Air Brake Co., Milwankee 14, Wis. Detailed specifications are included. Check the coupon for your copy.

#### Cleaning and Relining Water Pipe the Easy Way

397. Complete facilities for relining cast iron or steel water pipe lines in place from 4" to 144" in diameter, with both the Tate process and the Centriline process offered by Pipe Linings. Inc., 2414 E. 223rd St., Wimington, Calif. For full information on cleaning and relining pipe with only momentary interrupton of service, check the coupon.

#### Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, is feet long. Check the coupon for your copy, 18

#### Attractive Bulletin Features Large Elevated Tanks

252. In a 24-page booklet, "Horton Elevated Steel Tanks of Large Capacity," Chicago Bridge & Iron Co., Chicago 4, Ill., describes the advantages of using large elevated steel tanks to provide gravity pressure in municipal water systems. Detailed information on radial-cone tanks of 500,000 to 3,000,000-gal. capacity and Hortonspheridal tanks of 1,000,000 gal, is included in this really handsome bulletin. Check coupon for your copy.

#### STREET LIGHTING AND TRAFFIC CONTROL

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54. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy coupon. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn

#### Safe-T-Cones Solve Traffic Problems Night and Day

136. For data on Safe-T-Cones, the all-rubber traffic guides available in two sizes, 18" and 28"—painted or reflectorized for day and nightime use—get bulletin from Radiator Spe-cialty Co., Charlotte, N. C. Information in-cluded on Safe-T-Signs which add greatly to value of markers. Check the coupon now!

#### Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy

#### Helpful Data on Street Lighting Equipment

193. Complete data on Monotube street lighting poles together with information on brackets, mast arms and accessory attachments is available from Union Metal Mfg. Co., Canton 5, Ohio. Be sure you have the latest data on street and highway lighting equipment. Check the coupon now.

#### Street Lighting Application Curve **Eliminates Calculations**

257. An easy-to-use chart from which il-lumination level, spacing and proper mounting height can be determined has been prepared by the Illuminating Engineering Laboratory, General Electric Co., Hendersonville, N.C. For a copy of the chart and instructions on its use check the handy coupon.

#### Latest Data on Standards For Traffic Control Signals

258. All-aluminum standards and brackets 258. All-aluminum standards and brackets for mounting traffic signals over roadways and pedestal-type bases for signals mounted on the curb are described in a bulletin of Pfaff & Kendall, 84 Foundry St., Newark S, N. J. Check the advantages of these maintenance-free units when planning new installations and replacements. Use the coupon to get latest data.

#### Traffic-Actuated Controls For Every Intersection Problem

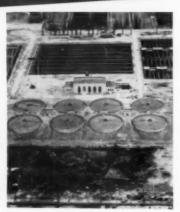
For Every Intersection Problem 392. Traffic control systems which continually adjust to changing patterns to relieve congestion at every type of intersection are fully described in a comprehensive set of bulletins available from Automatic Signal Div., Eastern Industries, Inc., East Norwalk, Conn. Whether your problem involves side roads entering main arteries, complicated street intersections, speed controls or other situations, you will find helpful information in this literature. Check the coupon today.

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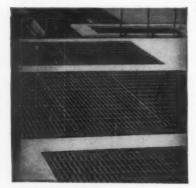
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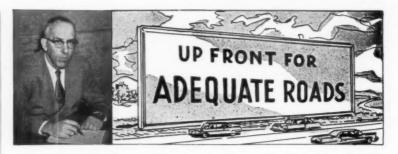
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#### by LEO J. RITTER, JR.

It's That Time Again - As we note every year, there are a number of state highway conferences scheduled for the spring of the year. Watch for them: At the University of Colorado, Feb. 23-24; at the University of Illinois, Feb. 28-Mar. 2; at the University of Utah, March 5-7; at Georgia Tech, Feb. 27-28; at Ohio State, April 3-5. There are several others, too. These are real fine deals, and every one can profit from attending the one in his state. Sometimes, engineers and officials of local governments don't seem to support these conferences too well. This is too bad, since there is a tremendous amount of practical and technical information to be gained at the average meeting of this type by attending the conference sessions, participating in the discussions, and engaging in the informal "bullsessions". Who knows? maybe you can find help in the solution of one of your technical problems by attending this year.

Highway Legislation - As this is being written (New Year's Day), the outlook for federal highway legislation is still very confused. However, the Administration is reported as being ready to adopt a more sensible attitude toward the whole program-sensible in the sense that it represents a more realistic outlook toward financing and undoubtedly will stand a much better chance of passing both houses. The Administration is reported as being ready to propose a "pay-as-you-go" program of \$25 billion, probably for a 15-year period. There may be a proposal for some bond financing, too. In all the time which has elapsed since the last Congress, no one has come up with any real solution to the financing problem. All the major groups in the highway field have adroitly sidestepped this aspect of the program. Maybe that's the wiser course, since traditionally highway appropriations have been handled separately from revenue measures, in both houses of Congress; then, too, no single group wants to stick its neck out and propose something that is bound not to be popular with all groups.

New in Education - The Highway Builder, published by the Associated Pennsylvania Contractors, carries a description of an interesting and unique school, first of its kind we've heard anything about. This unique institution is the National School of Heavy Equipment Operations, which is located near Charlotte, N. C. The school offers a four-week (218-hour) course in operating and maintaining heavy construction (earthmoving) equipment. About 1/3 of the time is spent in the classroom, and the remainder in observing and operating the equipment. The school, started a year ago, was founded by G. S. Shaw. Mr. Shaw now turns out 35 "graduates" every four weeks, with many of the graduates being immediately employed by contractors. Tuition for the course is \$250, plus \$11 per week for room and board. The shortage of good equipment operators should make attendance at this school an attractive proposition for many a young

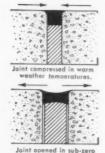
Information, Please - Sometimes this old hoss seems to be fresh out of ideas when the time comes to write this column every month, which it does with astonishing regularity. How about you? Got any fresh ideas? Seriously, we'd appreciate any suggestion you might have about this column and its contents. What would you like to hear about? Is there any particular subject you'd like to know more about? Have you had some interesting highway or street experiences you'd like to share with others? Drop us a twopenny postcard, giving us your views. The address is c/o Howard Hansen, Inc., 619 N. Washington St., Naperville, Illinois. Naperville is just west of Chicago-give us a





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buzz next time you're in the Windy City.

Monorail —At long last a monorail system is going to get a full-scale field test in this country. Extensively used in Europe for fast and economical urban mass transit, a monorail system basically involves suspension of a cab from an elevated track. An 830-foot monorail system, installed by private capital to the tune of 50 million dollars, should be in operation in Houston by the time you read this, It'll be interesting to see if the idea catches on in other parts of the country.

Dixie-Road programs are resurgent in the Southeast, after some dormancy in the last few years. Alabama may go ahead now and get its turnpike program under way; a number of Alabama officials and legislators recently visited Oklahoma and came back much impressed with Oklahoma's Turnpike. officials Meanwhile, local County Judges Ass'n. and County Highway Officials' Ass'n) in Tennessee have grabbed the ball and are running with it. From their preliminary work of the last few months will come the organization of a Better Roads Committee in each of 95 counties. In Florida, the first paving contracts on the 110mile "Sunshine State Parkway" are about to get under way; target date for completion is late this year. This section of the planned state-long route extends from North Miami Beach to Ft. Pierce. Things are looking up in the Tampa area, too, and the engineering firm of Pullara, Bowen and Watson has been engaged to prepare plans for road projects in that area. The Watson in that group was a graduate student of ours at the University of Florida some years back; a wonderful story teller and a good engineer,

Looking Ahead -Vision for the future is shown by the proposal by the Port of New York Authority for the construction of a heliport at the foot of West 30th Street, in midtown Manhattan. The facility will have dimensions of 200x400 feet, will cost about 5 million dollars, and will be built in 1960. At that time, predictions are that 2000 helicopter passengers per day will be handled on the west side of the city. By 1975, it is predicted that 6 million passengers, 40 million pounds of air mail, and 61/2 million pounds of cargo will move in and out of Manhattan by helicopter every year. Future heli"Heltzel Radius Forms are Excellent
Equipment that Really Make the Job
Easy" Says Superintendent of Streets...



City Street Superintendent looks over job on which Heltzel-Flexible Radius Forms are being used. (Right) Stripping Forms from completed radius curbing.

"We're pretty well sold on Heltzel Forms," says the Superintendent of Streets of one of the Midwest's fastest growing cities. "The contractors who do our work have used forms of many makes, but frequently compliment us on our choice of Heltzel."

This superintendent is not alone in his praise of Heltzel Forms. In fact, wherever users have honestly compared, they're almost certain to become regular Heltzel customers. For almost

half-a-century Heltzel has been making steel forms of every description for the contractors of America. No other group has the experience and "know-how" of Heltzel Form experts. If you are not already a Heltzel user, why not, when next you are in the market for forms — sidewalk, curb, curb and gutter, road, airport or specials, contact the Heltzel Representative nearest you and fin i out why Heltzel is the favorite of most construction people.



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Now's the time to mail this month's Readers' Service Card.

copters will be multi-engine aircraft, will weigh up to 50,000 pounds, and carry 60 passengers.

New Publications-A bright new little book-Motor Truck Facts- is available from the Automobile Manufacturers Association. New Center Building, Detroit 2, Michigan; also a new revision of the "Manual of Instructions for Concrete Proportioning Engineers", by and from the Bureau of Materials of Illinois Division of Highways, Springfield. Another one of those remarkable reports is by the Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. This one is "Modern Highways for Michigan", which is a sequel to the 1947 report on "Highway Needs in Michigan", one of the first of the state highway planning needs studies.

Caught in Passing-Seventy rodmen on crews of the Iowa State Highway Commission will receive a 3-month training course at Iowa State College, salary and expenses paid. Voters in New York state killed a proposal for a \$750-million bond issue for highways in elections last November. Construction on the 236-mile Kansas Turnpike is adhering to schedule and should be complete late in 1956. Look for a real cement shortage to develop in some areas of the country this summer; the industry has been caught in an embarrassing situation by its failure to expand rapidly enough (the antiquated, base-point pricing system hasn't helped, either). There is deep regret over the untimely death of General Frank Merrill of New Hampshire, just after his election as President of the AASHO. Construction of the 35-mile turnpike from Richmond to Petersburg, Virginia will begin soon.

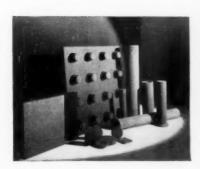
#### Sound and Color Movie Available

"Snow Road," the Colorado Department of Highways 20-minute sound and color movie is in its seventh year of showing the nation how Colorado keeps its mountain highways open through winter snowstorms. "Snow Road" is sent free to public and private schools, civic and church groups, other governmental agencies and associations, which are asked by the Colorado Department of Highways only to pay return postage on the film. Write to the Public Relations Division, Colorado Dept. of Highways, 4201 E. Arkansas Ave., Denver 22, Colo. for further information.

# Two ways you save with Norton plates

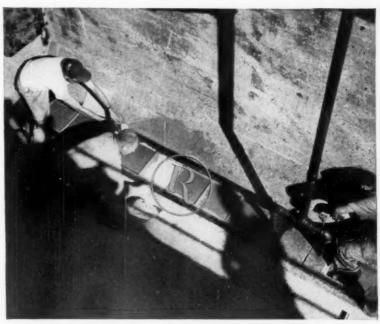
NORTON R

(engineered and prescribed)
porous mediums last
extra-long, reduce
maintenance in both
sewage and filtration
plants

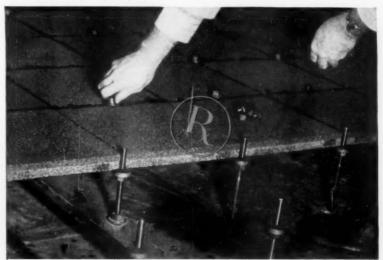


Public works engineers all over the country know that among the most dependable aids to efficient, economical sewage disposal and water filtration are Norton ALUNDUM porous mediums — engineered and prescribed for longest lasting, lowest cost performance.

Thanks to their controlled structure processing, Norton mediums have the even distribution of pores that makes them the ideal R for uniform diffusion. And Norton tubes have this uniform diffusion over their entire area, because of their seamless construction — which also makes them much



After 16 years of service, Norton ALUNDUM\* plates are replaced with new ones in a modern sewage disposal plant.



Good for many years to come. A water filtration plant makes sure of long, trouble-free service by installing Norton plates.

easier to clean.

You get additional savings

with Norton porous mediums because of their exceptional resistance to breakage and chipping and to cleaning acids. Made in the form of plates, discs and tubes, they cover a wide range of applications, including activated sludge aeration and gravity, pressure or diatomite filtration.

Norton can help you

by supplying illustrated booklets, charts, tables and other important information on your own use of porous mediums. Ask your Norton Representative or write direct to Norton Company, Refractories Division, 221 New Bond St., Worcester 6, Mass.



POROUS MEDIUMS

Engineered... R... Prescribed

Making better products... to make your products better

\*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

Get full details of this month's products . . . mail your Readers' Service card today.



...another plus feature available with

# **VALVES AND HYDRANTS**

PARLING mechanical joint valves and hydrants are built to approved standards and provide all the recognized advantages—such as simple, fast installation with no special skills required... and assurance of tight joints.

But whether or not you require mechanical joints, don't forget the outstanding performance advantages that only Darling Valves and Hydrants can give

you. For example, there's Darling's revolutionary B-50-B packless dry-top hydrant development with its ball-bearing operation and "O" ring seals. And in gate valves, Darling's fully revolving double disc, parallel seat principle... for long life, low maintenance and unmatched operating ease.

Be sure to get all the facts. Complete information is yours for the asking.

> Darling Revolving Disc Gate Valve with mechanical joints.







#### DARLING VALVE & MANUFACTURING CO.

Williamsport 22, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.

Thousands use our Readers' Service card to keep up to date . . . do you?



#### to bring you ALL the advantages of Rex Tow-Bro...at lower cost

Now, you can have ALL the advantages of the famous Rex® Tow-Bro Sludge Remover—at lower cost. You get the outstanding efficiency of Tow-Bro's gentle suction action that removes light, flocculent sludge with minimum agitation, high solids concentration, fastest removal rates—at far less cost with the new Unitube Tow-Bro design.

Here's a great new CHAIN Belt develop-

ment that's far more efficient than inferior scraper-type sludge collectors...assures far more effective and positive results. It's something you'll want to know about. It's the ideal sludge remover for any plant having light, "tricky" sludges such as activated sludge—round or rectangular...small, medium or large.

Get all the facts. Mail the coupon for the informative Bulletin No. 315-81. Don't delay.

CHAIN BELT

Milwaukee 1, Wis.

CHAIN Belt Company 4722 W. Greenfield Ave., Milwaukee 1, Wis.

Send me informative Bulletin No. 315-81 describing the new Rex Unitube Tow-Bro.

Need more facts about advertised products? Mail your Readers' Service card now.



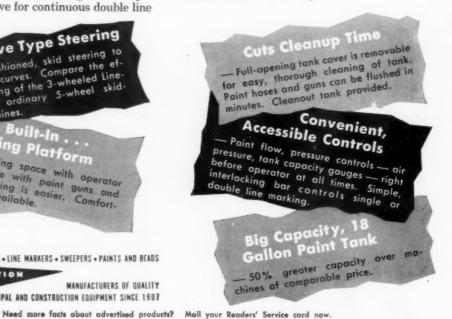
Big machine performance at low original cost! That's the all-new, double-line M-B Line-Master — the most advanced line marker available, having the extra features, rugged construction and line laying capacity of units carrying a much higher price tag. With the new Line-Master you have a marker engineered to do a better job than any other unit in its price class. Together with all the exclusive features shown below, you get additional advantages like ample power and air reserve for continuous double line

work; 3" to 6" wide lines, regular or reflective, solid or intermittent (with optional timer); big, heavy duty jet spray cups; a self-propelled marker, one-man operated with speeds of 3 to 5 miles per hour.

Be sure to investigate all the many Line-Master features before purchasing your new marking equipment. Write today for the new illustrated bulletin giving complete facts on this most modern of line stripers.







four different water supplementation one water treatment by GENERAL

The Plains Electric Generation and Transmission Cooperative recently completed at Algodones, New Mexico, provides 30,000 kilowatts per hour to Southwest consumers.



Consulting Engineers: Laramore & Douglass, Inc., Chicago, Ill.

cient quantities for fact different supplies wall togalized by the consulting engineses.

\*\*COOLING WATER for the consensation of turbine stoom.

\*\*SANITARY WATER for drinking and sanitation.

\*\*AMAKE-UP WATER for the boilers.

\*\*SERVICE WATER for the protection of a general utility.

Why the fastern installed age operator can discountly and count to

AERATORS • FILTERS • TASTE AND ODOR • ALKALINITY CONTROL • HIGH CAPACITY RESINOUS ZEOLITE • IRON RUST REMOVAL • DEMINERALIZATION • SOFTENERS



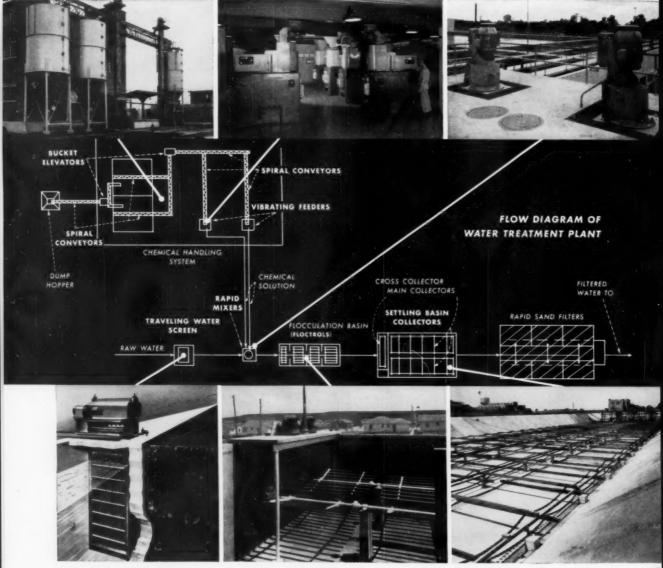
"... better water"

Now's the time to mail this month's Readers' Service Card.

Ask for recommendations for a water treatment plant "job-engineered" to your requirements . . . a fast, efficient, economical system by General Filter.

**Bucket Elevators** fill these storage bins. Spiral conveyors carry chemicals away. **Eight WAYTROLS** here in this waterworks automatically proportion chemicals for mixing.

**Mixers** insure proper blending of coagulant solutions, assuring most economical use of chemicals.



**Traveling Water Screens** remove all floating debris and suspended matter from plant influent.

**FLOCTROL tanks** give complete flocculation in shortest possible time, with minimum chemical usage.

**Sludge Collectors** for settling basins are designed for quiescent flow to speed sedimentation.

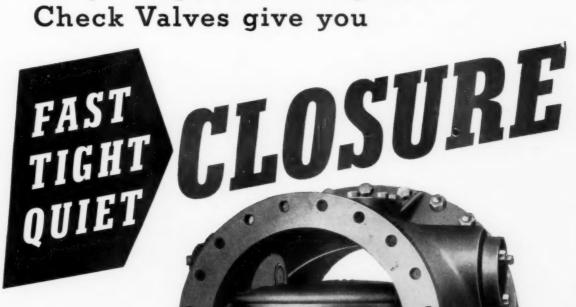
### let JEFFREY MECHANIZE your water treatment plant

JEFFREY's sixty-five years' experience with material-handling equipment qualifies the JEFFREY Sanitary Engineering Division to offer complete technical assistance on water treatment plant equipment and design. Catalog 833-A describes this equipment. The Jeffrey Manufacturing Company, Columbus 16, Ohio.



CONVEYING • PROCESSING • MINING EQUIPMENT •
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

### Only Chapman Tilting Disc Check Valves give you



Fast, quiet operation means
low cost operation for check
valves. That's exactly what the
Chapman Tilting Disc Check Valve is
designed to do. It won't flutter or slam and damage
the piping joints or the valve itself. The unique drop-tight

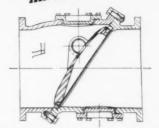
Rugged construction and low wear of the Chapman Tilting Disc Check Valves mean long life under severe operating conditions. Absence of vibration plus low head loss keep maintenance of the entire piping system at a minimum.

closure action eliminates scraping and wear of the disc and seat.

Whether for replacement or for new piping systems, be sure to specify Chapman Tilting Disc Check Valves. They're available in iron and steel for handling fluids or gases under a wide range of pressures. For full data on the complete line, write today. Ask for Catalog 30-A.

The Chapman Valve Mfg. Co.

Here's why
Chapman's Tilting Disc
Check Valves Keep Quiet
All of Their Lives



This specially designed "airfoil" disc balances perfectly in open position. The fluid holds the disc tightly against its stops without flutter. The body of the valve is larger around the disc, so the net valve area is at least as much as the pipe area to assure low flow resistance.

When the flow is reversed, pressure against the upper part of the disc cushions it as it closes. Then the disc drops easily and tightly to its beveled seat after the valve has swung closed. Seating is fast and quiet with minimum head loss in all but unusual piping arrangements.



Dointed

SANITARY DISPOSAL LINES

When engineers and sanitary officials of the Louisville and Jefferson County Metropolitan Sewer District specified TYLOX RUBBER JOINTS for new trunk sewers, they "played safe" on three factors that mean a lot in protecting public funds invested in waste disposal projects. Their TYLOX decision auto-

matically assured:-

No Infiltration - Passage of water in or out of the pipe joint is prevented by "compression-tight" Tylox Rubber Gaskets. Tylox Joints help reduce costs of sewage treatment.

No Joint Failures - The rubber of Tylox is specifically compounded to defeat sewerage and industrial waste corrosives. Under ground, and under compression, Tylox outlasts the pipe itself. Tylox helps reduce maintenance costs.

No Installation Delays - Flexible Tylox compensates for pipe angularities in any plane . . . permits wet-trench jointing and immediate backfilling. Tylox helps cut construction costs . . . keeps jobs ahead of schedule with more pipe laid per day.

> TYLOX is the one Pipe Joint which fully meets requirements of engineers, sanitary officials and construction men alike.

PROJECT - Trunk sewers for METROPOLITAN SEWER DISTRICT, Louisville, Ky.

ENGINEER-Morris Forman, Chief Engineer

PIPE-Over 31,000 feet of 60" and 70" reinforced concrete pipe manufactured by Kentucky Concrete Pipe Company, Frankfort, Ky.

CONTRACTORS—Ruby Construction Company, Inc., and W. L. Hailey and Company, Inc., Louisville, Ky.

> MAKING JOINTS WITH TYLOX RUBBER GASKETS IS AS SIMPLE AS

Cement tongue and snap on TYLOX gasket.

Lubricate sliding surfaces TYLOX cement.



Shove the pipe home to line and grade.

5000

Specify TYLOX RUBBER JOINTS and play safe on your next pipe job. Write for full information and more TYLOX case histories TODAY.

HAMILTON KENT MANUFACTURING COMPANY

427 West Grant St., Kent, Ohio ORchard 3-9555

Need more facts about advertised products? Mail your Readers' Service card now.

## TWO NEW POWERFUL HUBER-WARCO MOTOR GRADERS

28,500 H. P. 60 100 H. P. 25,000 1bs.

Torque Converter and Power-Shift Transmission



### Designed to Give the Power and Weight You Want in a Motor Grader

- Powered by GM 3-71 and GM 4-71 diesel engines.
- Tail Shaft Governor—automatically adjusts RPM to meet load conditions,
- Foot Clutch has been eliminated.

- Perfect balance of power and weight.
- Power Sliding Moldboard is standard equipment.
- Hydraulically Cab-Controlled Blade Movement—90° either side.
- Four Wheel Brakes—standard on 7D.

For a demonstration — see your nearest Huber-Warco Distributor



### HUBER-WARCO COMPANY

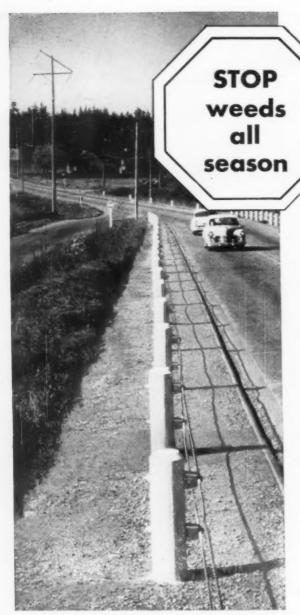
MARION, OHIO, U. S. A.

Road Machinery

CABLE ADDRESS: HUBARCO

ROAD ROLLERS . MOTOR GRADERS . MAINTAINERS . GRINDERS

It's a fact . . . our handy Readers' Service card is the way to get new cutalogs.



Note how "Telvar" has kept the guard-rail area free of vegetation. Untreated section at left shows kind of growth involved, growth that causes fire hazards, cuts visibility and often impedes drainage.

FREE ILLUSTRATED BOOKLETS describe how to control weeds and brush with Du Pont chemicals. Write to Du Pont, Grasselli Chemicals Dept., Rm. D-4032, Wilmington, Del. In Canada, Du Pont Company of Canada Limited, 50 Rich...ond Street West, Toronto, Canada.

# Spray just once with Du Pont TELVAR®

WEED KILLERS

When you use "Telvar" weed killers, vegetation is killed through the roots and regrowth is prevented because the chemical remains in the soil . . . provides residual action all season long. And low dosages (1 to  $1\frac{1}{2}$  lbs. per 1,000 sq. ft.) make it cost little for the results you obtain. Such low rates also mean less handling, less use of storage facilities.

"Telvar" weed killers come as wettable powders, are non-corrosive, non-flammable, non-volatile, low in toxicity to humans and livestock.

Include "Telvar" weed killers in your weed-control program this year. Prove to yourself how these products of Du Pont research can help cut your maintenance cost to new low levels.

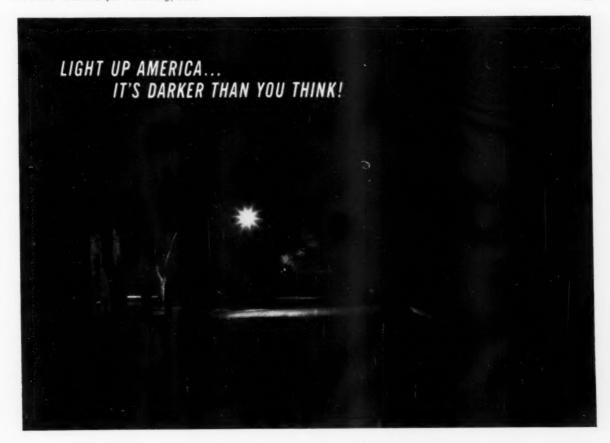
Where brush is a problem, Du Pont Ammate® X weed and brush killer is the product you need. It kills more kinds of brush with unusual safety. With ordinary precautions, "Ammate" X may be used close to such crops as cotton, tomatoes, soybeans and peanuts.

On all chemicals, follow label instructions and warnings carefully.



WEED and BRUSH KILLERS

BETTER THINGS FOR BETTER LIVING ... THROUGH CHEMISTRY



### Someone will get credit for lighting this street. Who will it be?

Pretty soon something's bound to happen on a dark street like this, and when it does, someone will spearhead a drive for good public lighting. He'll get what he's after, too, because who casts a vote for darkness on his community's streets?

"Out of Darkness" a new, dramatic film story of how one community met its street-lighting problems, is now available to civic groups, community service organizations, etc. This 16-mm, sound, black-and-white movie runs 26 minutes. Borrow a print of "Out of Darkness" from your nearest G-E Apparatus Sales Office.

And when the lights come on, business picks up, accident rates drop, there's less crime. Streets look safe and prosperous - and they are.

The cost? Good street lighting is the least expensive capital improvement you could sponsor.

	E455-10 Lighting Department,
	Electric Company, Schenectady 5, N. Y.
	nd me a free copy of the 16-page bulletin, "Residential phting," GEA-6316.
Name	
Street	
City and S	itate

Progress Is Our Most Important Product



Cet full details of this month's products . . . mail your Readers' Service card today.

### TELEMETERING

with unique new freedom from maintenance!

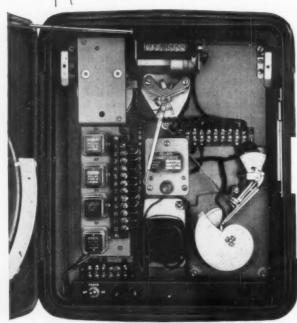


### TELETAX by Foxboro

Transmitter

ANY TRANSMISSION SYSTEM

two wires one wire and ground radio or microwave carrier current



Receiver

You can now get the full benefit of Foxboro accuracy and reliability for remote measurements, too! Teletax, the Foxboro impulseduration system, brings new durability and simplicity to telemetering. For example, in the compact Teletax Receiver, dust-proof, plug-in relays and a husky reversing motor drive the recording pen positively. Maintenance is all but eliminated. And when servicing is necessary, every component is easily replaceable as a separate unit.

Teletax will transmit any measurement made with standard Foxboro measuring elements. Accuracy is 1/2% of full scale . . . regardless of normal variations in signal strength. Get full details on Teletax efficiency and economy. Write for Bulletin 17-11.

### Most Practical System You Can Get!

RELIABLE: Thoroughly proved in actual field installations.

**ECONOMICAL:** Operates on lowest-cost transmission circuits.

LOW MAINTENANCE: A few drops of oil in the receiver motor every three months is all that's required; low 5 ma dc signal avoids failures.

Single or dual transmitter or receiver; indicating or recording; totalizing available.

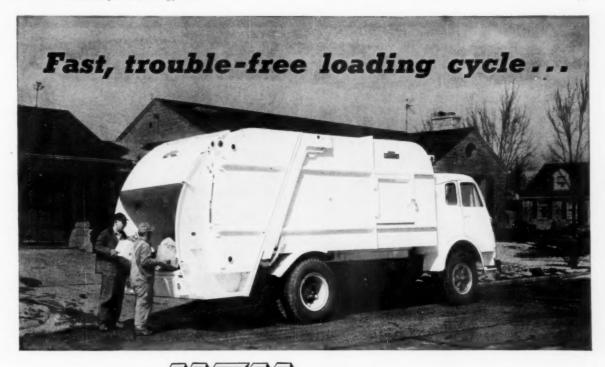
262 NORFOLK STREET, FOXBORO, MASSACHUSETTS, U.S.A.

REG. U. S. PAT. OFF

TELETAX (impulse-duration) Telemetering

UNITED STATES, CANADA, AND ENGLAND FACTORIES IN

Thousands use our Readers' Service card to keep up to date . . . do you?



### with MENG Colectomatic

**Finger-tip Control.** Here's timesaving simplicity — the touch of a lever starts the completely automatic loading and packing cycle. A single hydraulic cylinder closes the safety door and raises the hopper. Then the single-cylinder packer sweeps load out of hopper and begins packing action. In just 23 trouble-free seconds, the safety door opens for the next load.

**Horizontal-Thrust Packing Action.** The packing plate is located high in the hopper to provide better leverage . . . exerts a stronger packing action against the load through horizontal thrust. This packs a maximum amount of refuse into the body, reduces the number of unloading trips, assures better collection service.

Simplified Operation. By reducing the number of operating parts, the Heil Colectomatic eliminates trouble. There are no chains for refuse to jam in...only two hydraulic cylinders control entire work cycle, a third controls body dump. Should refuse jam between packing plate and floor of hopper, a push of a stoppage control lever drops hinged hopper and loading cycle begins again in seconds. It all adds up to lower maintenance, more money saved for the taxpayer.

### THE HEIL CO.

DEPT. 4426, 3044 W. MONTANA ST., MILWAUKEE 1, WISCONSIN

Factories: Milwaukee, Wis., Hillside, N. J., Lancaster, Pa.

Heil Sales Offices: New York; Union, N. J.; Lancaster, Pa.; Atlanta, Cleveland, Milwaukee, Chicago, Kansas City, Denver, Dallas, Los Angeles, Seattle

### OTHER COLECTOMATIC FEATURES TO SIMPLIFY REFUSE COLLECTION

Quiet Operation

No clanking chains, minimum truck engine acceleration when loading.

Comfortable Loading

Low, wide sill allows two men to load hopper side by side.

Simplified Servicing

All lube points can be reached through panel door on each side of body.

• Fast Dumping

Flat floor, obstruction-free tapered body provide fast, clean dumping. Load distribution on axles provides good stability while dumping.

Safety

Load-packing mechanism is completely enclosed. Safety door protects personnel from flying debris.

Compact Body

Allows better maneuvering when loading in narrow, restricted areas. Get a demonstration from your Heil distributor and see the fast, troublefree operation of a Colectomatic.

NEW HEIL MOVIE, "Made to Order," describes new Colectomatic in full sound and color. Address requests for free use to The Heil Co., Body and Hoist Division, Milwaukee 1, Wis.



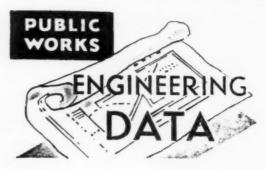


Here's the handiest machine you ever owned -a fast, low priced, mobile tractor-mounted trencher for utility lines, foundations, sewer systems, septic tanks, etc. You'll find this ladder-type trencher working all the time. Cuts 6" to 20" wide trench down to a depth of 7'. Average digging speed 350' to 400' per hour — digs up to 800' per hour. Cuts through all soils the year 'round. Special chisel type cutters for rocky or frozen ground. Independent control of each drive wheel assures exact and easy regulation for either straight or curved trenches. Mounts on Ford or Ferguson tractor - easily driven from job to job - one man operated. Bulldozer blade available for backfilling. Write for all the facts today.

### ARPS CORPORATION

Dept. P. W. NEW HOLST!

PRODUCTS FOR BETTER FARMS, BETTER INDUSTRIES SINCE 1920



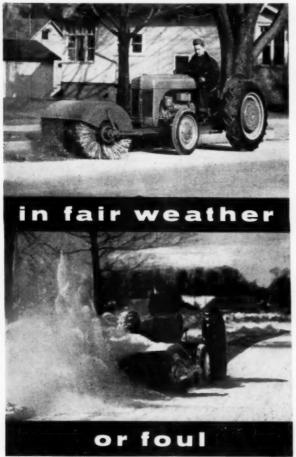
### Maintaining 7,987 Miles of Highway is Costly

During 1954, Colorado had the obligation of maintaining 7,987 miles of highways. The Department of Highways contracted the maintenance of 1,948 miles of Federal Aid Secondary and Non-Federal Aid State Highways to the counties in which they were located. The state reimbursed the counties \$777,947.61 for this work and this accounted for 11.56 percent of the total maintenance expenditure. In like manner, 186 miles of state highways located within cities were contracted and the State paid the affected cities \$184,446.26 or 2.74 percent of the total maintenance expenditure. The remaining 5,853 miles of the State Highway System were maintained by the State and the operation amounted to \$5,759,210.98 and accounted for 85.7 percent of the total maintenance budget. An analysis of this 85.7 percent reveals that the supervision maintenance and operation of equipment accounted for 25.93 percent or \$1,745,726.73; the maintenance of road surfaces and drainage accounted for 34.07 percent or \$2,293,613.06; the maintenance of bridges amounted to 1.28 percent or \$85,893.47; the removal of snow and ice and the sanding of highways was 6.61 percent or \$444,607.90; traffic services in the form of signing, striping and the maintenance of guard fences and roadway delineators accounted for 9.48 percent or \$638.053.33: the replacement of obsolete equipment plus the purchase of any new equipment required 6.54 percent or \$440,568.40; and property purchase amounted to 1.79 percent or \$120,810.00. This data is from the 1954 annual Highway Report of Colorado.

### Field Laboratory for Bituminous Construction

The Iowa State Highway Commission requires the contractor to furnish the field laboratory on secondary contracts. "On primary construction contracts the Highway Commission has been furnishing the laboratory. The laboratory which the Highway Commission furnishes has been a converted school bus. In this bus the seats are removed and tables in:talled for laboratory work. We have built a few trailer type laboratories but find that they are not as convenient as the bus because they require some additional means for transportation whereas the bus is equipped with its own power. The one objection to the bus at the present time is that the ones available have headroom only 5 ft 10 ins. For tall inspectors this is a little inconvenient."

Specification provisions for field laboratories are as follows: For each unit of equipment for mixing bituminous concrete on secondary road contracts, the contractor shall furnish a suitable mobile field laboratory for the exclusive use of the inspectors. Such a laboratory shall provide floor space not less than seven by ten feet. It shall be weather tight and



### Ms sweepers keep . . . tractors busy year 'round

Your tractors do double duty with M-B Sweepers keeping streets and sidewalks safe and clean during all seasons.

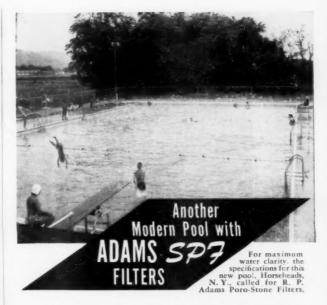
In Winter your tractors are put to work sweeping snow from streets, parking areas and skating ponds. Milder weather brings multiple uses on all public thoroughfares.

Look At These Superior M-B Features!

Longer wearing fiber brushes — 5' & 6' widths — 30° sweeping angle; hydraulic controls raise brush 8" to clear curbs and obstructions; dust hood (easily removable for snow sweeping) keeps dust down to provide better operator vision; floating action broom compensates for uneven brush wear and follows surface contour; brush quickly removable for drawbar work; broom may be disengaged while traveling; sprinkler attachment available; M-B sweepers completely engineered and ready to mount on most popular tractors.

More Streets and Roads Are Kept Clear With M-B Sweepers Than Any Other Kind!





Yes, here's another distinctive pool with the popular Adams Poro-Stone filters. More and more public pools are insisting on Adams Filters, and there are many good reasons why. Here are two of the important ones.

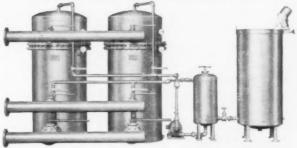
First, the exclusive ADAMS HI-FLOW backwash design gives you simple and easy cleaning . . . no messy disassembly . . . no scrubbing of filter elements. The high air dome and unrestricted backwash ou let provide complete purging of the filter tubes with high velocity water.

Second, rugged 41/4" O.D. PORO-STONE elements with nearly 40% open area are unaffected by corrosion. The first Adams swimming pool filter—in use since 1938—still has the original PORO-STONE tubes.

There are numerous other reasons why it pays to specify and buy Adams SPF filters. Get all the facts by writing for your copy of Bulletin 625. Use the handy coupon below.

### R. P. ADAMS CO., INC.

228 EAST PARK DRIVE BUFFALO 17, N. Y.



The Double SPF-129 Poro-Stone filter shown above provides 258 square feet of filter area . . . will handle pools of 371,500 gallons capacity at 774 gallons per minute recirculation flow. It is ideal for outdoor pools such as the 268,000 gallon Horseheads pool.

R. P. ADAMS COMPANY, INC. 244 EAST PARK DRIVE, BUFFALO 17, N.Y.	F-2
Please send me by return mail your new	Bulletin 625.
Name	Γitle
Business	
Street	
City	State
City	



The composite picture above shows four different views of the switchyard structure recently erected at the Georgia Power Company's new Plant Hammond, near Rome, Georgia.

The structural steel in this installation, as well as the transmission line towers are Hot-Dip Galvanized. Hot-Dip Galvanizing is the best rust protection you can buy and in the long run inexpensive. Here's why—with Hot-Dip Galvanizing you get the thickest, most uniform coating with no open pores to let rust begin—thus costly maintenance over a period of years is reduced to a minimum and necessity for replacement is eliminated.

When you have a rust problem, choose Hot-Dip Galvanizing—the best rust protection you can buy. For the best in galvanizing send your products to a member of the American Hot Dip Galvanizers Association—he has the know-how to give you a top quality job.



have ample window space. At least 30 square feet of shelf space shall be installed in the laboratory as directed by the engineer. The contractor shall furnish not less than four outlets for lighting and two double convenience outlets, located in conjunction with the shelf space, with connections for not less than 2,000 watts and shall furnish water for testing purposes at the laboratory. Each laboratory shall be equipped with fire extinguishers of the carbon dioxide type. On primary road contracts the laboratory building will be furnished by the Highway Commission. The laboratory shall be located as directed by the engineer and shall be moved at his direction as work progresses. The furnishing of electricity and water by the contractor, shall be considered as incidental to the work and the cost thereof to be included in contract price for other items.

### City Operates Bus Line as Service

The local bus line in Merrill, Wisc., is now being operated by the city as a municipal service for its citizens. The action was approved by more than a three to one vote at an election last spring.

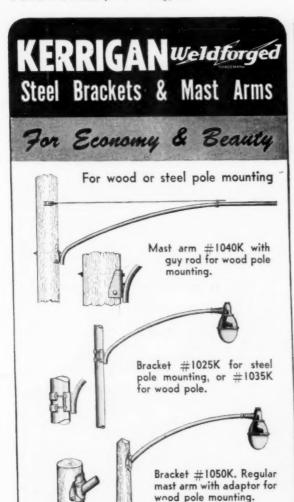
### Future Needs for Water

The demand for water will increase with every step in the growth of our population and every step of our scientific discoveries and inventions. The Bureau of the Census projects the population of the United States to a high of 221,000,000 people in 1975. Per capita, consumption of water was estimated at 125 gallons per day in 1946. Latest estimates indicate water consumption has increased to 140 gallons per day in the larger cities. The results of these two contributing factors indicates an increase in municipal water consumption of about 4.5 percent per annum

A study made by a task force states that our industrial needs (including cooling water) will rise in the next 25 years by an estimated 138,000,000,000 gallons per day; and that domestic consumption will rise in the same period by another 7,000,000,000 gallons per day. By 1975 the total prospective increase for domestic and industrial use over present amounts will be 145 percent—equal to the additional supply of 145 New York cities, requiring the flow of about 11 Colorado rivers. The above information is from "Water Resources and Power", a report to the Congress by the Commission on Organization of the Executive Branch of the Government.

### Statistics on Municipal Operations

The following information was included in the Annual Report of the Street and Engineering Department of Oakland, California. During the fiscal year 1954-1955 street dedications totaling 0.12 mile were added to the City's street system and this brought the total city mileage to 772 miles. These streets were classified as follows: Improved 600 miles; graded and oiled 129 miles; and unimproved 43 miles. There were 8.50 miles of storm drainage conduit added to the drainage system the last fiscal year and this brings the total to 118 miles. Also, 8.21 miles of sanitary sewers were added, bringing the total to 858 miles. There were 77,017 curb miles of street cleaning in the fiscal year 1954-1955 with a total of 24,824 cubic yards of street sweepings and refuse collected. During the same period there was 158,840 tons of garbage collected by contract under the Garbage Disposal Section.



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Cincinnati Arena, Cincinnati, Ohio

Pool and Recreation Conter, Providence, R. I.

Veteran's Administration, Richmond, Va.

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Brownsville Boys Club, Brooklyn, N. Y.

"Boys' Club of America", Newark, N. J.

Jewish Community Center, Milwaukee, Wisc.

Veterans Foreign Wars Pool, Thomasville, Ala.

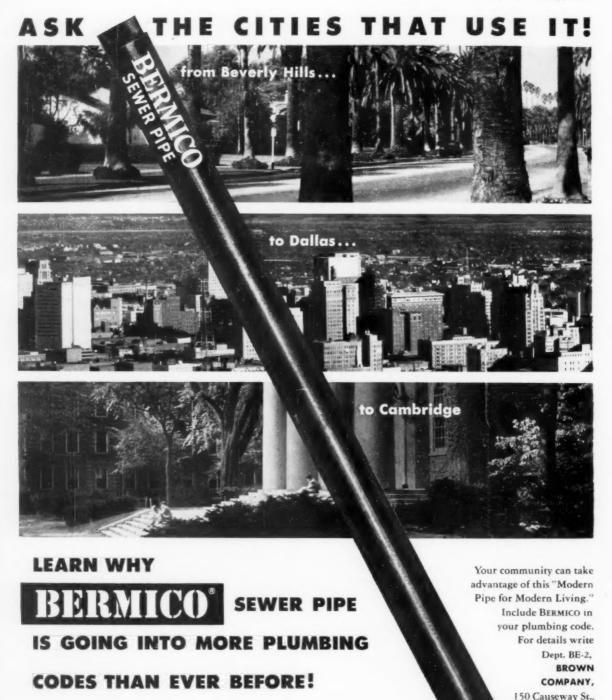
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On busy express routes the use of Bros Self-Propelled Rollers keeps the traffic moving.



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### SP-54 — THE FIRST ALL REAR WHEEL DRIVE ROLLER WITH FULL OSCILLATION OF WHEEL PAIRS

Tractive effort is maximized by positive chain drive to all rear wheels. No dead wheel to get the roller "hung up" or cause skidmarks. Only the SP-54 with full oscillation of all wheel pairs provides even wheel loads and uniform compaction densities. One-half inch overlap of wideface front and rear tires provides full 100 percent surface coverage.

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Torque converter drive provides smooth, even flow of power to the drive line... smoother starts when reversing directions, and prevents tearing up freshly laid surfaces. Provides an infinite range of operating speeds in both forward and reverse.

### SHUTTLE GEAR AND 3-SPEED TRANSMISSION SAVES TIME

A shuttle gear and 3-speed transmission provides the same speeds in reverse as in forward range. Fast shuttle or reversing gear saves time by eliminating shifting through the transmission when changing direction.

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Hydraulic brakes on both rear wheel pairs can be operated separately. When braking one pair, drive power is transferred to the other pair thus preventing the roller from being "hung up" where traction is difficult.

### EASY HANDLING BY HYDRAULIC STEERING

Uniform or constant speed hydraulic steering provides smooth, sure control at all engine and roller operating speeds. Turns easy and fast in 18 ft. radius.

### BROS SELF-PROPELLED ROLLERS DO THE TRICK; ALSO END ACCIDENT HAZARD OF ROLLER TURN-AROUNDS

Keeping vital traffic arteries in shape previously created bottle-necks, rerouting problems and accident hazards during maintenance operation. No Bros Self-Propelled rollers with torque converte, and reversing gear solve those problems and bring all the advantages of pneumatic tire rolling to seal coating jobs.

On the busy Belt Line that circles the Minneapolis-St. Paul metropolitan area, heavy traffic continued to roll right along side two Bros 7-ton Self-Propelled units during seal coating of 7.6 miles of pavement.

The job engineers report that traffic and work flow were maintained *only* because the Bros rollers with reversing gears required no turn-arounds.

Rolling was done in 2 passes. Each of two 9' and one 11' strips were completely covered by the two rollers in a single pass.

This straight-line rolling keeps work moving right along with the spreader unit, saving time and money. And no tearing up of freshly laid tar and chips at turn-around points occurs.

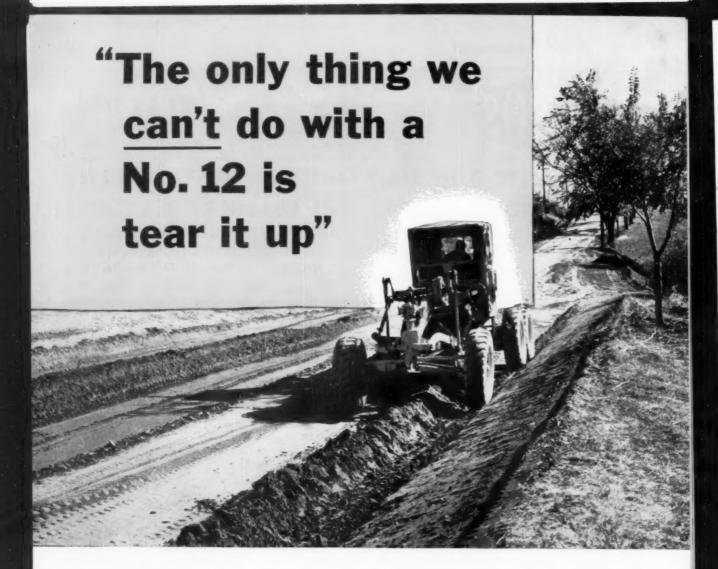
Smoother starts, fast reversing, easy steering, visibility all around were among other important advantages of the SP-54s on this job. Read more about these features below!

### WHERE CONDITIONS PERMIT, TOW A ROLLER FOR FASTER RESULTS



On school grounds, parking lots and other areas where turn arounds are possible, you can tow a roller with the SP-54 and get results twice as fast.

The SP-54 is powered by a 50-HP engine. A towing hitch on rear of the body. Get complete information on the SP-54—the best roller for mat surfacing, seal coating and standard lift compaction jobs. Write: Wm. Bros Boiler & Mfg. Co., 1057 Tenth Ave. S.E., Minneapolis 14, Minnesota.



Summer and winter, Leavenworth, Kansas, keeps its Caterpillar No. 12 Motor Grader on the go. Look at the partial list of jobs done by this versatile machine, as reported by Superintendent Bernard J. Cassella, of the Department of Streets and Public Improvements:

"Has opened six blocks of streets in one month, making cuts up to six feet deep...ditches and fills streets, and prepares them for oiling...cuts and windrows up to 800 yards of dirt a day for our Athey loader...rips up old asphalt...mixes cold asphalt...with Athey loader and another grader keeps 53 downtown blocks clear of snow. The CAT\* No. 12 is great for punishment. The only thing we can't do with it is tear it up," Mr. Cassella says.

This No. 12 gives the residents of Leavenworth a real return on their tax dollars through low operating costs and high production. And the new No. 12 is better than ever. Among other improvements it has the exclusive Caterpillar Oil Clutch, which reduces wear, can give you 1500 hours without adjustment.

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PUBLIC WORKS MAGAZINE

> FEBRUARY 1956



# ROAD MANAGEMENT PAYS OFF...

VICTOR W. SAUER, Road Commissioner, Contra Costa County, California

THE BIG PAYOFF in Contra Costa County, California, Public Works Department has been on road management. Post war population increases and industrial growth with the attendant increases in traffic resulted in rapid deterioration of rural rods. In recent years the percentage of County population growth has been about twice that of the State of California.

In 1951 an engineering survey was made of the adequacy of the County Road System. This survey formed the basis of the present \$10,-250,000 bond issue, approved at the 1952 election, which provided some eighteen miles of new roads, bridges, an underpass, an interchange and the improvement of sixty miles of existing roads. Recognizing the need for continuing capital improvements to reduce maintenance costs and provide for future traffic needs of the County, the Board of Supervisors decided also to maintain a substantial annual capital improvement road budget.

For the execution of the bond issue and regular road program, the organizational needs of the department were determined to be:

 A broad policy guidance to meet the challenges created by the change of many County highways from rural, farm-to-market roads to urbanized streets and highways serving commuter and industrial traffic.

2. A flexible organizational structure permitting ready expansion and contraction of activities, with maxi-

mum utilization of engineering personnel.

3. Clear, complete definitions of the responsibilities and authorities of each major organizational unit.

 The maximum delegation of authority consistent with personnel competency and needed managerial control.

5. An adequate engineering staff.

6. Functional specialization within the engineering field where the volume of work justified it or where lack of fully qualified personnel required it.

7. The use of the administrative tools of planning, organizing, staff-

ing, directing, coordinating, reporting and budgeting.

8. Adequate physical facilities to take care of the expanded program.

Not all of these needs could be met immediately, but an increased engineering staff to handle the bond issue was urgent. By January, 1953, the Department was using 21 new engineering positions on the first bond projects. The number was increased to 36 by January, 1954. It was recognized that these were conservative additions and that after the Bond program was completed, a sizable staff would still be necessary.

The use of specialized engineering personnel became feasible and ne-



 ASSISTANT Road Commissioner-Surveyor George L. Berry (left) and Design Engineer F. R. Brown, Jr., (right) confer with an assistant on a road drainage problem.

cessary in the latter part of 1952. A Materials & Testing Engineer came to work in January 1953, to set up and operate a materials laboratory and to make extensive soils and geologic surveys of the County. A Traffic Engineer position was established in March, 1953, to meet the increasing number of urban traffic problems.

The shortage of professional engineers and the large volume of work led, in 1953, to the creation of non-engineering specialized positions of construction inspector. Men of wide practical experience and road building know-how were recruited for these jobs. Similarly the growth of survey needs meant the development of the specialized survey position of instrumentman and chief of party and these were activated in March, 1954.

Trained surveyors became a necessity to carry out the large volume of preliminary and final location design surveys, construction staking, and ties to the California Lambert Grid system. As the work volume grew, engineering aides were added in larger quantities to do computing, record keeping, drafting and related tasks, so as to free the professional engineer from the more routine tasks.

### **Utilizing Engineers**

Another significant move in getting the highest professional work from engineering personnel was to concentrate non - engineering functions under administrative personnel. Accounting, personnel, purchasing, property management, record keeping, duplicating and right of way appraisal, negotiation, and acquisition were placed under nontechnical personnel. To paraphrase a Biblical injunction, we render unto engineers what pertains to engineering and unto business administrators all the rest, particularly the red tape mill.

It was decided early that a permanent increase in staff sufficient to complete the bond issue work by the 5-year deadline was unlikely. Therefore, design and survey contracts were let to local engineering firms. The first contract was placed in 1952 and approximately \$1,900,000 of such work is currently under contract. Further, the Division of Highways of the State of California designed and supervised construction of one major bond project, an interchange with a state freeway, contributing \$100,000 to its cost because of the importance of the interchange to the State Highway System. Additionally, temporary personnel have been added as necessary and available to keep the bond and other capital improvement work moving in the field and on the drawing boards.

Of basic importance in the administration of the Department are the policies established by the Board of Supervisors. The State Collier-Burns Highway Act of 1947 provides for the position of Road Commissioner and states: "The Board shall determine the general policies of the County as to County Highway matters and the same shall be carried out and administered by the Road Commissioner."

The Board of Supervisors of Contra Costa County developed and adopted a comprehensive pattern of basic policy statements which are essential to effective operation of the Public Works Department. Some are in the form of ordinances and others are written resolutions or verbal expressions: These include County-Wide Road Administration; Subdivision Ordinance: Drainage Ordinance; Driveway Connections to County Roads; Road Acceptance Policy; Contract Work; Aid-to-Cities Program; and Roads Reconstruction all of which are effective. The Street Cut Ordinance, Model Traffic Ordinance and Curb and Gutter Policy are under study. These policies provide a broad and firm base for the organization and operation of the Department. They give the Public Works Department sion that a minimum annual expenditure of \$3,000,000 (exclusive of engineering and administrative salaries) would be the most reasonable basis to use for predicating an engineering organization and its staffing. This figure covers two main categories of Public Works Department work: 1. Capital outlay for construction and reconstruction and 2. Maintenance.

A review of the division of 1952 costs shows that the amounts of capital outlay and maintenance were about the same; but after three years of the present program of reconstruction, the unreasonably high per mile maintenance cost has been reduced from \$1.665 to \$1.050 per mile. As total maintenance costs continue to be reduced, a greater portion of the department program will be shifted to construction and reconstruction in order to accelerate bringing roads up to standard and to keep pace with the needs of a growing County. A constant, level appropriation of \$3,000,000 a year for the next few years will mean a reduction in the tax rate for roads as assessed valuations rise and state subventions and fines increase. Further savings will accrue to taxpayers and road users through fewer accidents, lower insurance rates and lower operative costs.

The \$3,000,000 program will no doubt eventually have to be increased as our maintenance mileage continues to grow and as we tend



 RESIDENT ENGINEER Dex Ahlgren (left) and office assistant Merle Hunter discuss cross-section quantities for a Contra Costa County road construction project.

clear and definite guidance in large areas of its work.

An analysis of the broad road financial picture, including the road appropriation history for several prior years, led us to the concluto reach a minimum maintenance cost per mile. The total maintenance costs, though dropping from a high of \$1,558,500 in fiscal year 1953 to \$1,055,250 in fiscal year 1955, will ultimately reverse in trend unless

our maintained mileage begins to remain constant or to be reduced by annexations to cities or incorporations. However, for the next few years a \$3,000,000 program should be appropriate.

We agreed upon the following assumptions, or premises, as a guide for the determination of our staffing requirements and of our organiza-

tional breakdown:

3. An annual budget of \$3,000,000 would be the base for staffing requirements, further broken down as follows: A. During each construction year, at least \$1,500,000 of new construction or reconstruction (including betterments) would be accomplished. The remainder of the \$3,000,000 would be used for maintenance. B. During each design year, \$2,000,000 of plans would be finalized. This figure was selected to provide a yearly backlog of \$500,-000 in plans over the \$1,500,000 scheduled to be constructed. The \$500,000 backlog is needed to permit the design group, in three years, to be able to design a year ahead of construction, permitting better planning and scheduling of projects. The backlog also provides for an increase in the yearly amount of construction possible as lowered maintenance costs permit a greater portion of the budget to be used for construction.

The average annual salary of an engineer in this department was set at \$5,000, and the upper limit of our engineering salary costs at about ten percent for construction and ten percent for design. Therefore, the engineering salary costs for construction for a \$1,500,000 year would be \$150,000 and those for design for a \$2,000,000 year would be \$200,000. An indeterminate but substantial portion of the 10 percent figure must go for service engineering involving innumerable meetings, conferences and contacts with the public at all levels; to issue permits; explain plans; make surveys, obtain right of way and test soils.

The engineering required of our Department is of two fundamental types: A. Basic Engineering and B. Service Engineering.

Basic engineering is that required for the planning, design and construction of roads and streets and associated structures. Service engineering is that required of the engineering staff which does not directly affect the specific design or construction of a road or road structure. Included in this category are engineering services furnished other county departments and other

governmental agencies; those required for accumulating information from engineering investigations and to improve design, construction and maintenance standards and specifications; those for administration of ordinances, public relations and liaison; and those for mainte-

Business Advisory Group). Each of these three report directly to the Public Works Director.

The day-in, day-out departmental engineering activities are carried on in the Operations Group. Except for the Maintenance Division, the Operations Group is primarily con-

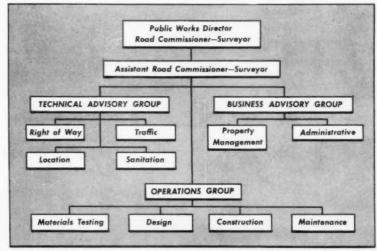


TABLE of Organization of the Contra Costa County Public Works Department.
 Specific duties of various groups are discussed below and on the following pages.

nance. Service engineering requires a high percentage of our time but is essential. We plan to try to determine the amount of service engineering we do since the question is not only important to us, but we find engineers of other public jurisdictions have an interest in it and are finding the percentages surprisingly large.

### **Department Organization**

Following the premises we have just discussed, we laid out our organization. The engineering functions were divided into six major divisions: 1. Location (planning); 2. Traffic; 3. Materials and Testing; 4. Design; 5. Construction; 6. Maintenance.

These have been further arranged into two major groups: 1, Technical Advisory (Location and Traffic) and 2. Operations (Materials and Testing, Design, Construction and Maintenance.)

The Technical Advisory Group is directly responsible to the Public Works Director (who is also the Road Commissioner & Surveyor), and the Operating Group reports to the Assistant Road Commissioner-Surveyor. Three additional divisions are necessary: Right of Way (a part of the Technical Advisory Group); Property Management; and Administrative (the latter two forming the

cerned with basic engineering as we have defined it earlier. The Materials & Testing Division serves the Design, Construction and Maintenance Divisions by providing soil analysis and quality control of materials, and by investigating and making recommendations on slides and sub-surface drainage problems.

Proposed plans and specifications of the Design Division are reviewed by the Construction Division to determine their construction practicability and by the Maintenance Division for ease and economy of maintenance of the completed product. Engineering personnel must be shifted from Construction to Design and back again as emphasis shifts from summer construction to winter design, and the cycle is repeated. All these elements point to the desirability of placing the four divisions under a single head to coordinate and supervise their activities. The size of our Department's activities makes the four divisions the most practicable number for the Operations Group.

The divisions of the Technical Advisory Group are more diverse in their activities than those in the Operations Group and are placed together primarily because they tend to be more largely service and staff in nature than operational. The Location Division is the Public

Works Director's engineering staff division. The Traffic Division has a considerable degree of public relations and serves also in a staff capacity. The Right-of-Way division provides a service to the Operations Group by procuring the road rights of way as specified by the Design Division.

The Property Management and Administrative divisions care for the non-engineering activities of the Department. Their work is separated from engineering in order to permit engineering personnel to concentrate on engineering and to enable the Department to use business specialists to handle the not inconsiderable business activities involved in its work.

rying out its policies. The Director attempts to delegate as much work, with attendant authority, as possible. With more than three hundred personnel and a complex road system to manage, it would not be possible for one man to make all decisions and to review all work. A large element in the success of our delegation of authority is due to the high quality personnel provided by the merit system.

Location: This division is the highway planning and engineering staff arm of the Department. It prepares preliminary engineering reports, maintains close liaison with the County Planning Commission and with Federal, State, County and City agencies whose work affects

County highways. It also serves the County as a whole in acquiring and selling County property. In addition to its major function, the division as needed serves as the rental agent for County property obtained in connection with roads right-of-way acquisition or for other purposes. Arrangements have been made with the County Flood Control and Soil Conservation District for this division to handle all their right of way matters also.

**Traffic:** This division may be said to split its functions three ways: one-third engineering, one-third records and reports, and one-third public relations. It makes geometric design studies, analyzes needs for traffic controls, records accident



 PLACING concrete in the forms for a triple box culvert where Pine Creek crosses the Ygnacio Valley road extension.



 ROADWAY excavation and compaction in progress on the Ygnacio Valley project. Low bid for entire job was \$547,528.

After we completed our initial draft of our organization as described above, a new function relating to a County Master Plan for sewerage was added to the Department. We have given the function the status of a Division and have it reporting directly to the Public Works Director. The function is still in the formative stage so that its final position in our organization has yet to be determined.

Additionally, the functions of the County Surveyor have been added to the Department. The major functions of the Surveyor were allocated to the Location Division, a few were given to the Maintenance Division, and the business and administrative functions were given to the Business Advisory Group. This is an example of the flexibility of our organizational structure.

After that overall look, let's look at the various divisions in more detail.

Public Works Director: The Public Works Director is the agent of the Board and is charged with car-

highways. It maintains map and road records.

This division also administers the County Subdivision Ordinance, including providing inspection on subdivision roads and other improvements; maintains the official County map; and develops the horizontal and vertical survey control network for the County. As the Bond Construction program is completed, the inspectional work of this division will be transferred to the Construction Division.

This division also administers all of the Department's surveying, providing parties as needed for design, construction, maintenance or other work. The use of the pool concept has given us added flexibility and has been a means of savings, because we are able to move men easily from one kind of surveying to another and we are developing men of wide surveying skills.

Right-of-Way: This division appraises, negotiates for, and acquires for the County the rights of way for

data, accumulates traffic information, and meets constantly with the public explaining traffic safety, discussing traffic proposals, and giving advice on specific problems.

Sanitation: This division will prepare the County master plan for sewerage, will assist in the formation and modification of Sanitation Districts and other political jurisdiction, handling sewerage for particular areas; will review proposals for the creation of treatment plants, trunk lines, and interceptor lines; and will act in a staff capacity for the Board of Supervisors in the Administration of Sanitation Districts.

Property Management: This division is responsible for the procurement, issuance, and accounting for departmental supplies, materials, and equipment; for the procurement and management of all the County's automotive and other mobile equipment; and for the procurement and utilization of the space and lighting used by the Department. The cost of operating County owned passenger cars has been reduced to

4.76¢ a mile. This cost, which includes depreciation and operation costs, compares with the rate of 8.2¢ a mile which was the average rate paid to employees who were driving their own cars.

Administrative: This division is responsible for personnel administration, accounting, budgeting, organization and methods studies, and for clerical, stenographic, typing and duplicating services. This division will coordinate a systems and procedures study which is pending, will continue to refine the organization and staffing studies, and will review and integrate departmental policies.

Assistant Road Commissioner-Surveyor: The Assistant Road Commissioner-Surveyor is responsible for coordinating and supervising the Operations Group of the Department, including scheduling projects and analyzing bids; for administering the Aid-To-Cities program; and for acting as the Public Works Director when directed.

Materials and Testing: This division is responsible for testing all material used for design, construction and maintenance purposes; for investigating soil conditions; for recommending pavement and foundation design; and for investigating pavement failures, foundation failures and slides. The division is also developing soils maps of the County.

Design: This division is responsible for preparing preliminary and final designs for new construction, improvements to roads and bridges, and repairs to bridges; for preparing specifications; for making engineering estimates of costs; and for advising other divisions on design matters. The division also does the right of way engineering for the County and heads up the drainage activities of the Department, including liaison with the County Flood Control and Soil Conservation District.

Construction: This division is responsible for administering construction contracts; for providing necessary inspection work performed by County forces; for providing inspection for street cuts and other encroachments into County roads and rights of way; and for accepting work, materials, and projects as in accordance with specifications and as meeting County standards. The division works with the State of California specifications. Each resident engineer writes a full report on the completion of each of his projects.

Maintenance: This division is responsible for the maintenance of



 COMPLETED intersection represents work of personnel in the location, rightof way and business groups as well as design, materials and construction sections.

County roads and structures on, in, and under roads and roads rights-of-way to such standards as will insure safe and convenient usage of the County highway system; and for the performance of such construction work with County Forces as may be authorized. It also supervises sewer maintenance districts and is responsible for the County sidewalk repair program.

### Engineering Personnel

After the organization was developed, we studied the numbers of the various kinds of engineering personnel needed to carry out the \$3,-000,000 road program and the accompanying service engineering activities. Translating an annual design program of \$2,000,000 and a construction program of \$1,500,000 into specific kinds of engineering personnel to do definite jobs was a cut and try proposition. We finally arrived at figures which appear to be fair. It has been estimated that

about 1 to 3 percent of a project's cost might be allocated to materials engineering. For basic materials and testing engineering, we used 2.18 percent, which gives us 4 1/3 employees. For construction engineering, including resident engineers and inspectors, but not surveys, we allocated 6.15 percent which gave us 221/2 employees. For design, we allocated 7.87 percent which gave us 23 employees. To surveys we allocated 5.28 percent to be divided between construction and design. This amount gave us 22 employees. The total percentage for basic engineering is 10.8 for design and 10.89 for construction. We are convinced that we can cut these costs to well under 10 percent for each after we gain experience in operating, and are using them primarily as guides.

In determining what levels of personnel were needed for various jobs in design, we decided to use the squad concept. Our design division



 FOUR-LANE passing section on the \$1,750,000 Pleasant Hill Road project. The traffic division cooperates with other groups on such traffic and safety problems.

was proposed to have 5 squads of 5 men each. Three squads would have three Civil Engineering Assistants, one Junior Civil Engineering and one Senior Engineering Aide. The remaining two squads were to have two Civil Engineering Assistants, two Junior Civil Engineers, and one Senior Engineering Aide. One squad would be active only during the winter and would be composed of engineers from the Construction Division.

Two of the squads would work on current year projects, two would work on future year's projects (one of these would be the temporary winter squad) and one squad would be used on bridge and structures design.

Because each squad has two or three Civil Engineering Assistants (which are our journeyman level engineers), the squads could be divided to do several different projects each or could remain a unit to complete one large project. This flexibility is important in our organization which has several large and many small projects to design each year.

The two current-projects squads and the two future-projects squads would each be headed by a Civil Engineering Associate. Because of its relatively more stringent engineering requirements, the single bridges and structure squad would also be guided by a Civil Engineering Associate.

In our survey party staffing we are trying to minimize our field survey costs by using contour maps made from aerial photographs for locations of new routes. Except where wooded areas affect their accuracy we have found that the contour maps may also be used for earthwork quantity take-offs, thus eliminating expensive cross-section-

ing for design purposes.

Our Construction Division staffing for basic engineering has 5 Civil Engineering Assistants and 4 Junior Civil Engineers to serve as residents and assistant residents on projects. These are supervised by a Civil Engineering Associate who could in a pinch serve as a resident on a very large job. In this staffing, we again have to retain a high degree of flexibility in order to cover all the kinds of construction projects occurring each year. Conceivably we could have five \$300,000 projects, each of which would be headed by a Civil Engineering Assistant. More likely, we will have a few large and many small projects so that some Junior Civil Engineers will get the chance to be residents each year.

Our total engineering staffing picture of course is tentative and has to be tried in order to be finally set; however, we feel that by making an effort to work the staff out in advance of use, we have developed guides which will enable us to do a better job of evaluating our progress as the staffing arrangement goes into action.

We are beginning a study of our basic maintenance personnel needs. To date, since July 1952, we have been able to abolish 57 positions as surplus, as a result of normal attrition, such as resignations and retirements. Also, since October, 1953, we have made surplus and sold 18 pieces of heavy equipment originally costing \$56,265 and presently have 15 pieces originally worth \$89,170 up for sale. This reduction we attribute to relatively less need for maintenance as we continue to expand our program of reconstruction. In addition, we are using our maintenance personnel less and less to perform construction work and are doing more and more construction work by contract. Our goal is to develop trained maintenance crews, organized, staffed and equipped especially for maintenance work.

### Maintenance Personnel

While we do not yet have firm figures on the number of personnel we need for our basic maintenance crews, we are approaching the problem from several standpoints. We are getting information on what personnel are performing maintenance work, and for what amount of their time. (Our problem here is that our maintenance crews perform construction work as well as maintenance work.) We are looking at the various maintenance jobs to be performed in order to re-evaluate both the kinds of personnel and the most efficient types of equipment needed. We are re-examining the locations of our maintenance yards to see if the need for specialist maintenance personnel may be reduced by some means of combining yards. The County has hired a time-motion expert to make recommendations on where our main corporation yard should be located.

As organization and staffing have been major management areas to be cared for in our immediate past, we are turning now to our operating methods and techniques as the next field of work. From the beginning, delegation of authority has been made to division heads to the extent of their willingness and capacity. The division heads in turn have been encouraged to redelegate as necessary and desirable. Without such delegation it would be impossible for the work to have been accomplished. However, delegation of authority is not an unmixed blessing. Standards and limits for action must be established and efficient reporting systems devised.

When our organization was smaller, most controls could be exercised by personal contact; delegations could be specific for the task and the follow up made by oral reporting. As the organization grew, however, staff conferences began to replace individual conferences and policies had to be written rather than word of mouth. We are now beginning to get written reports of work accomplished and are starting to develop policy manuals to give uniform and comprehensive guidance to all our supervisory personnel. A simple forms control program has been begun with the aim of getting a continuing review of procedures and work operations. During the winter, we also plan to get a comprehensive review made of all our methods and procedures in order to re-examine not only how we are operating, but also to look objectively in detail at what functions we are carrying on.

One final word can well be said on personnel because people are the most important part of any organization. Our basic personnel policy is to provide an atmosphere stimulating individual growth, development and activity. We believe that the best employees are those interested in their work, eager to learn, and given opportunities to develop.

We transfer our personnel from one division to another to broaden their outlooks and increase their skills. We have a continuing program of training supervisory personnel in the maintenance division through monthly meetings. Our chiefs of party meet regularly to discuss job problems, survey techniques and standards. Recently to get stake punchers, chainmen and rodmen in full production quickly, we conducted a five-day 40-hour training session over a specially set up field training course. If our plans work out, we will begin this year, in cooperation with our local junior college, an engineering in-service training program, which will permit our engineering aides and non-professional engineering personnel to make up their academic deficiences toward becoming professional engineers. Also, in the talking stage is a rotation on-the-job training program for junior engineers just out of college.

# THE DESIGN OF STORM SEWERS

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CALCULATION of runoff is one of the first and most important steps to be taken by the engineer who must design a storm sewer system. The function of a storm sewer is primarily to carry storm water, surface water and street wash or drainage rather than sewage or industrial wastes. So the capacity and extent of a storm sewer system depend on different factors than those which influence the size of a sanitary sewer system. Where population density and distribution, and number and kind of industries dictate the size of a sanitary sewer, the intensity, duration and direction of rain storms are more important in designing a storm sewer. Slope and condition of the surface of the area to be served must also be considered in preliminary planning.

Authorities emphasize the desirability of getting the facts essential to a successful design before spending money on construction. They refer to the "unpleasant consequences of under-estimates of runoff". The same authorities suggest the importance of knowing what portion of total rain or storm water should be the objective in planning for a storm sewer. They point out that, of the total volume of water falling on the surface of the earth, some is evaporated, some sinks into the earth, a part is absorbed by vegetation, part goes to fill depressions and the remainder flows over the surface until it reaches natural or artificial chan-

### Storm Runoff Formulas

There are a number of different formulas and methods which may be used in determining sizes of storm sewers required to drain any specific area. What is generally known as the rational method is based on the assumption that for any watershed the maximum rate of runoff for a given intensity of rainfall will occur when all parts of the drainage area are contributing. The general expression Q = ciA will serve to find the relationship between rainfall and runoff. The symbols can be as follows:

Where Q = quantity of runoff in cfs

c = coefficient of imperviousness

i = intensity of rainfall in inches per hour

A = contributing area in

Following this expression to a conclusion involves four general steps: (1) Selection of intensity—duration rainfall curve to fit local conditions; (2) determination of a runoff factor or coefficient of imperviousness; (3) location of proposed sewer line and inlets on a contour map and outlining drainage areas which contribute to the inlets; and (4) computation of sewer sizes from above data.

Frequently the engineer will find sufficient local rainfall data from which he can plot an intensity-duration curve showing storm intensity in inches of rainfall per hour and duration of rain in minutes. If local rainfall records prove inadequate or are not available, bulletins of the United States Department of Agriculture or state agricultural experiment stations will provide helpful information.

In plotting the intensity-duration curve the engineer will do well to observe the curves shown by maximum storms of a magnitude which are not expected to be exceeded for long periods. Although it might be desirable to build a storm sewer for the maximum runoff conditions occurring perhaps once in 20, 50 or 100 years, it would not be practical because the cost would be prohibitive. For this reason the design problem is to choose a storm frequency period



 CONSTRUCTION of a 96-in. diameter pipe sewer for the Marginal Conduit at Boston, Mass. The invert of the pipe is about 10 feet below the level of the river.

### TABLE 1-IMPERMEABILITY FACTORS

Type of Surface	Percent Impermeability
Watertight surfaces such as roofs and pavements	70-90
Block pavements with open joints	50-70
Macadam pavements	25-60
Gravel surfaces	15-30
Parks, cultivated lands, lawns, etc., depending on	
slope and character of soil	5-30
Wooded areas	1-20

that will call for sewers of a size economically feasible for the area concerned.

If records showing intensity and duration of a maximum storm which has been exceeded once in a 20-year period are plotted, a ten-year frequency curve is obtained. If the intensity and duration are exceeded twice in 20 years the curve will be a 7-year frequency curve. Three to five-year frequency curves are quite commonly used in designing storm sewers.

The runoff factor will be variable, depending on the percentage of impervious surface in the area to be drained and the character of the soil; and also depending on the duration of the rainfall and the shape of the drainage area. The area of impervious surfaces such as roofs, sidewalks and hard pavements may be estimated and given a percentage of imperviousness.

Harold E. Babbitt, former Professor of Sanitary Engineering at the University of Illinois, in his book on Sewerage and Sewage Treatment.

gives impermeability factors for various surfaces assumed to be dry and on flat slopes, as shown in Table I.

Porosity of soil is an important factor. Naturally a sandy soil will absorb a higher percentage of rainfall than a clay soil. The engineer should also remember that maximum runoff does not occur until the entire surface of the drainage area is wet and the depressions are waterfilled. That is why the duration of the storm affects runoff.

### **Runoff Factors**

The values which are generally assumed for the runoff factor in different parts of the drainage area are naturally based on impermeability factors such as are given by Prof. Babbitt. These may be considered as:

(a) Densely built-up, downtown areas 0.70-0.90; (b) dense residential areas (apartment buildings) 0.50-0.70; (c) less built-up residential areas 0.25-0.50; and (d) park lands and undeveloped districts 0.10-0.25.

The area A of surface runoff in the expression Q = ciA, can of course,

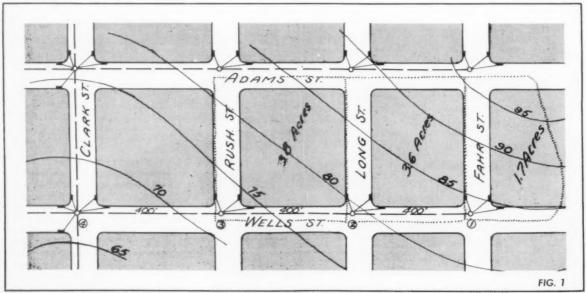
be definitely determined by actual measurements. Likewise the area which contributes flow to each sewer inlet can be plotted on a contour map as a part of the tributary area.

Time of concentration, or the time that elapses before water from the farthest portion of the area reaches a certain point in the sewer, must be considered in applying the rational method of sewer design. This time of concentration comprises two increments. One is the time of flow on the surface from the most distant point in the area to the first inlet. The other increment is the time of flow in the sewer.

In order to determine the cubic feet per second runoff at any point along the sewer line, first look at the rainfall intensity in inches per hour (i) as shown on the intensity-duration curve for the total time of concentration up to that point. Then substitute this (i) in the formula Q = ciA where A is area in acres and c is the runoff factor, and the approximate cfs runoff can be computed.

The following is an example of how this calculation may be applied to an actual problem in the design of a storm sewer:

Suppose that concrete pipe sewers are to be used to carry the runoff from the area indicated in Fig. 1. Inlets will be located at about 400-ft. intervals and at street intersections. The areas contributing to each manhole are computed. It is assumed that: Runoff coefficient, c=0.40; minimum velocity in the sewer is 3-ft. per second; time of concentration is 15 minutes to first manhole;



PLAN FOR STORM SEWER design discussed above. Design begins at the uppermost inlet and proceeds downstream.

LOCATION		AREA			Time of Flow (min)				DESIGN				PROFILE						
Street	From	То	Incre men	Total	č	To Inlet	In Pipe	.i.	·Q	Pipe Size	5/90e 11/4	'n	Capa- city (full) cs.s.	V H/sec	Lengh (H)	Fall (F4)	Other losses	ekv.	Inv.
WELLS ST.	0	0	1.7	1.7	.40	15	-	4.4	2.99	12	.0075	.013	3.0	3.0	400'	3.0	-	76.00	730
"	2	3	3.6	4.3			2.2	4.2	7.22	15"	.0/30		7.4	6.0	400	52		72.33	67.1
	3	@	38	8.1			1.2	3.9	1261	18"	.0/50		12.9	7.3	400	6.0		66.46	60.4

COMPUTATION SHEET for storm sewer design shows calculations made for pipe size and slope required in the example.

and design storm is a five-year frequency storm.

The design of the sewer system is begun at the uppermost inlet which is at (1), Fig. 1. The area contributing to this inlet is found to be 1.7 acres. This is entered in the proper column of the computation sheet, Fig. 2.

The time of concentration or the time required for runoff from the most distant point to reach the inlet is assumed to be 15 minutes; or field studies may be made during storm periods to determine the actual time. From Fig. 3 the intensity of rainfall for this period is 4.4 ins. per hour.

### **Calculating Runoff**

The quantity of runoff can now be calculated by the formula  $Q=\mathrm{ci}A$  where c=0.40, i=4.4 inches per hour and A=1.7 acres. The runoff is 2.99 cubic feet per second. To maintain a velocity of 3-ft. per second a 12-in. pipe will be used. A short calculation using Manning's formula will show that a slope of about 7.5 ft. per thousand is required to maintain this velocity. With this information it is possible to complete the first line of Fig. 2.

Knowing the velocity of flow and the distance from inlet (1) to inlet (2), it is possible to compute the time required for the runoff to travel to

inlet (2). This time is 
$$\frac{400}{3} = 133$$
 sec.

or 2.2 minutes. This added to the time of concentration for inlet (1) gives the total time of concentration for inlet (2), which is 17.2 minutes. Referring to Fig. 3, the rainfall intensity is about 4.2 in. per hour.

The contributing area for inlet (2) is 4.3 acres. This is composed of 1.7 acres contributing to inlet (1) and 3.6 acres contributing to inlet (2).

The size and slope of pipe required can then be computed as previously indicated. This procedure can then be repeated for each inlet and its contributing area.

The size of the required sewer is determined frequently by minimum and maximum velocity limits. The minimum velocity is that which will carry grit and sand particles in suspension when the sewer is flowing full. It is generally set at from 2.5 to 3 ft. per second. A maximum is established to limit the abrasive action of the grit and sand. The maximum velocity should be held to about 8 to 10 ft. per second for the peak storm during a two or three-year period.

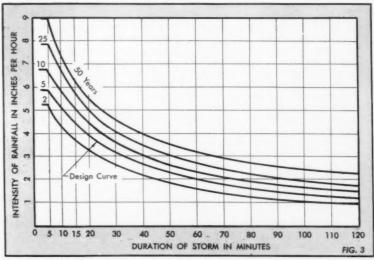
Storm sewers are generally designed as open channels flowing one-half to two-thirds full and then checked against the velocity limits mentioned above. The most common

formula in use today for this design is the Manning formula which is

$$v = \frac{1.486}{r} r^{2/3} s^{1/2}$$

where v is the velocity in the sewer; r is the hydraulic radius of the sewer, (the cross sectional water area divided by the wetted perimeter); s is the slope of the water surface; and n is the coefficient of roughness. The cross sectional water area of the sewer is equal to the design discharge divided by the velocity.

The design also includes a determination of increasing sewer sizes as the line moves toward the outfall to include water picked up from laterals along the way. Adequate size should also be provided for extensions of the sewer to outlying areas with additional consideration of increased runoff as these outlying areas



• RAINFALL intensity curves. The design curve is for a 5-year frequency storm.

are built up with impervious materials.

The available slope of the sewer is determined by the slope of the land to the point of discharge or by the number of pump lift stations to be built on flat land. Smooth pipe with low values of the Manning roughness coefficient n permit the consideration of smaller slopes. With good construction, careful alining of pipe and smooth joints a value of 0.013 for n has become standard practice for concrete pipe and vitrified tile pipe sewers. For large concrete pipe, n will be 0.013 or, with careful construction, even lower. It is important to use a Manning n-value in the Manning formula rather than arbitrarily to use n from another formula such as Kutter's.

Although the steps outlined are preliminary to actual design and construction, in usual practice the engineer at this stage will have recorded on maps the information necessary to design. Most cities have maps available showing streets and important topographic features. In some instances tax assessor's maps or maps used by public utilities may be of help.

Some preliminary field work must also be done so that maps or field notes will show type of paving in streets and alleys, subsurface conditions, ground water level, location and elevation of sanitary sewers, water mains, gas lines or electrical and telephone conduits. The proposed location of the trunk line and laterals should be sketched clearly on the street map with arrows to show the

direction of flow and the location of inlets or catch basins and manholes.

### **Outlets and Inlets**

Locating the outlet or outfall of a storm sewer is an important preliminary step. Usually there is no objection to discharging storm water into a convenient natural stream, lake or bay. One precaution is necessary, however. It must be remembered that when there is a heavy discharge from the storm sewer the stream into which it empties is also likely to be rising. It is desirable to locate the outlet of the storm sewer above the point at which water might back up into the system. Sewer outlets may be equipped with a gate or flap valve to prevent backup when the stream is high.

In a large city, or in some areas, it is sometimes possible and usually desirable to construct two or more outlets into a stream at different points or to discharge into more than one body of water. In any event the proposed location of outlets for a storm sewer should be shown clearly on a contour map during the planning stage so that all officials concerned or any interested property owners may be informed.

At this stage of a storm sewer project the designer may also sketch the tentative location of extensions of the system which may be required in the future. This advance planning may save considerable money for the municipality when annexation of territory or suburban developments necessitate additional storm sewer facilities.

### Addenda by the Editors of Public Works

Actually measured rates of rainfall are often unavailable and, when this is the case, a rainfall formula may be used to provide reasonable data for design. Talbot's formula is quite widely used. For Northeastern United States, for ordinary storms, values may be obtained by plotting a curve based on i=105/(t+15), where i is intensity of rainfall in inches per hour and t is the time period in minutes under consideration. Another quite commonly used formula is i=15÷√t. The indicated rainfall by this formula is somewhat higher than is given by the Talbot formula mentioned. There are a number of other formulas also available.

Where data are lacking or where, for other reasons, it is difficult to use the rational method of determining runoff; or for the purposes of a general check on the results obtained by the rational method, an empirical formula may be employed: The Burkli-Ziegler formula is perhaps most used. It may be written:

 $Q = ciA 4\sqrt{S/A}$ 

Where Q is the runoff in cubic feet per second: i is the maximum rate of rainfall in inches per hour over the entire area, based on experience, but usually not less than 1 nor more than 3 ins, per hour: S is the slope of the ground surface in feet per thousand feet: A is the area in acres: and c is a coefficient describing the relative imperviousness, usually having a value of about 0.7.

Inlets are designed to divert storm water from the street gutters into the storm sewer. Many engineers prefer to place the inlets near street intersections in such a position that cross walks will not be flooded. However, inlets may be located at midpoint where the blocks are longer than 500 ft. or at intervals sufficient to prevent flooding of the street.

Three types of inlets are in common use. One is designated as a curbopening storm water inlet. Another is a gutter grating inlet set nearly flush with the gradient of the gutter. Some cities used combined curb openings and gutter gratings. The dimensions of either type of inlet will depend on the amount of storm water to be diverted. Inlets may be built with or without catch basins which by some have been considered necessary to prevent clogging of sewer lines with grit and storm debris. In some sections of the country there is a trend away from catch basins for storm sewers unless the drainage is from sandy areas certain to carry a high percentage of suspended grit. It is believed by some engineers that correct sewer grades and careful construction will make it preferable and more economical to use simple

### Manholes

Many engineers believe it has been demonstrated that manholes are necessary to the efficient and economical operation of a storm sewer system. Certainly, properly designed manholes facilitate cleaning out silt, grit and other debris which is bound to accumulate especially after a major storm.

In sewers up to 60-in, in diameter, recommended practice is to locate a manhole at every change of direction, grade, elevation or size of pipe. In sewers too small for a man to enter most authorities prefer to space manholes not more than 300 to 500 ft. apart. It is desirable to locate manholes at street intersections if distances apart are in accordance with good practice. It is recommended that a numbering system be set up for manholes starting consecutively from the manhole at the lowest point in the line and continuing upward. Manholes are often constructed of cast-in-place concrete but may be built of concrete, brick or block. In recent years precast manholes in sizes up to 48-in. in diameter have been available in many concrete pipe plants.

Having determined the size of the sewer line and the velocity of flow for efficient operation, the engineer must also make sure that the sewer pipe itself will withstand whatever external loads may be imposed on it. These will be the loads representing backfill in the trench and static or live loads transmitted from the surface of the ground.

Care should be taken to see that tractors, bulldozers, rollers and other pieces of heavy equipment do not cross the pipe until the backfill is high enough to prevent an excessive load on the pipe. There may be points where railroads or highways will cross a storm sewer. Sufficient cover over the pipe will prevent damage.

With a cover of 6 ft. or more of backfill over a pipe tests have shown that only a small percentage of a surface load is transmitted to the pipe. A tabulation showing the percentage of surface loads transmitted to conduit with various depths of backfill, was published in Proceedings of the Highway Research Board, Vol. 26, 1946, p. 179. A considerable amount of research on the loading of underground conduit has been done at Iowa State College.

### **External Loadings**

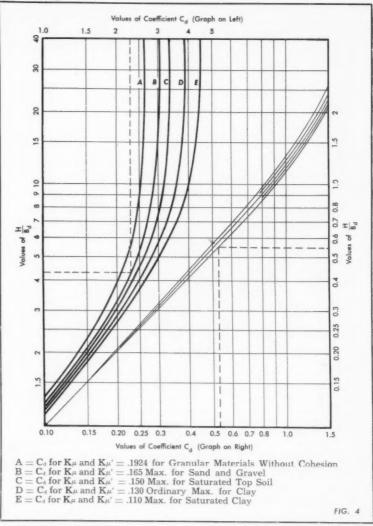
The load-carrying capacity of a sewer pipe is dependent to a considerable extent on the method of bedding in the trench. Four classes of bedding have been found to have different load factors in tests made at Iowa State College. (The load factor is a ratio of the supporting strength in the field to the strength as determined by the ASTM 3-edge bearing test.) The four classes of trench bedding and their load factors are shown in Table 2.

### Table 2—Trench Load Factors

Class of Bedding	Load Factor
A-Concrete cradle	2.25-3.4
B-First class	1.9
C-Ordinary	1.5
D-Impermissible	1.1

In Class A or cradle trench bedding the lower part of the pipe is set in a concrete foundation extending up on both sides for not less than 25 per cent of the height of the pipe.

In Class B or first class trench bedding the pipe is set in fine granular material on earth shaped to conform to the shape of the lower part of the pipe for a width of at least 60 percent of its external diameter. The trench is then backfilled with granular material tamped in 6-in. layers to fill the space on both sides and particularly under the haunches of the pipe and extended



### COMPUTATION diagram for earth loads on completely buried trench conduits.

for at least 1 ft. above the top of the line.

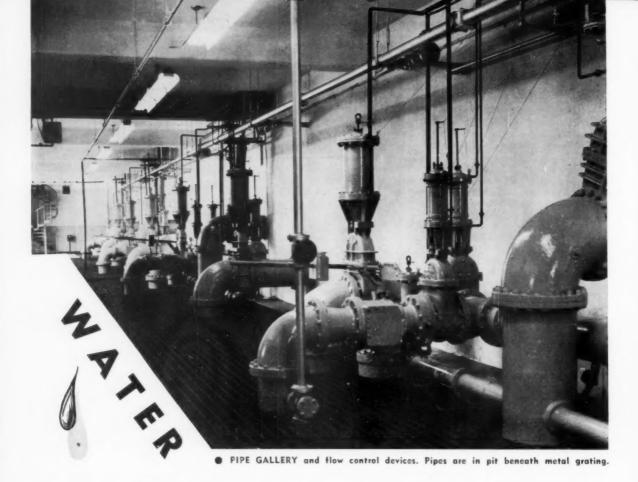
In Class C or ordinary bedding, the pipe is placed on an earth foundation shaped to fit its lower part for a width of at least half of its external diameter. Then trench is backfilled with granular material tamped to fill all spaces and extending at least 6 ins. above the top of the pipe.

In the Class D bedding, which is not usually recommended and should generally be avoided, little or no care is taken to shape the earth under the pipe and no care is taken in backfilling to insure filling the space under and around the pipe.

The importance of care in trench bedding of sewer lines cannot be over-emphasized. In fact, carelessness in any construction step can cause serious difficulties in sewer operation and result in unduly high maintenance costs regardless of the care taken in designing and laying out the line. Unless the finished construction is on established line and grade as shown in the plans and specifications, the sewer will not function as intended. For example, if a pipe settles below the invert gradient at any point, its capacity is reduced in proportion to the settlement. That is true because the settled section of the line quickly fills with suspended matter which must be cleaned out again and again.

The loading on sewer pipe is the pressure of the earth on pipe in the trench after it is backfilled. Most of the available data on the action of earth pressures on pipe are a result of research at Iowa State College done by Dean Anson Marston, M. G. Spangler and others.

(Continued on page 134)



### is building another county

GUY BROWNING ARTHUR

CITY-COUNTY partnership A holding power to plan, finance and build a water system without elections is making Cobb County, Georgia, one of our most progressive communities. Elections are not held, but the support of the public is cultivated by publishing detailed information about all plans and operations. The haggling and disputing in electioneering is eliminated; questions are answered fully and promptly; and opposition to development has steadily diminished. The tax-conscious critic becomes a whole-hearted supporter when a water main is laid along his prop-

This is another county compelled to progress by economic circumstances. It adjoins Fulton County and the city of Atlanta across the Chattahoochee River. Atlanta, the state capital and the big city of the Southeast, spreads its metropolitan area farther and farther in all directions, and in a sense "possesses" Cobb County and its activities. The county and its county seat, Marietta, might have continued as a rural community. But isolation was doomed when the state bisected the county with 4-lane highways leading out to the northwest from Atlanta.

Another step was the construction, during the war, of an aircraft plant near Marietta. Suddenly the work force of the county was augmented by 28,000 new employees, compelling the construction of a tremendous new volume of housing. The area did not lose these newcomers when the Bell plant was closed down, for they could commute into Atlanta, only 15 miles away, and they were the beginning of steady growth for the county.

Some 20 years earlier the southern part of the county undertook to build a water system. In 1946, plans were drawn by Merritt & Welker, of Marietta, for a larger system. Now the city and city officials saw

that they must take another look into the future, and the result of their efforts was Georgia Law #319, creating the Cobb County-Marietta Water Authority, of 1951. The Authority is composed of three members: the chairman is the County Commissioner of Roads and Revenues, one member is selected by the Mayor and Council of Marietta, and the third member is chosen by these two. The novelty is that this body can plan for the future of the county without limit, and for water and gas improvements it may finance with revenue bonds without going through an election.

It is not a retail business. The law authorizes it to serve not only Cobb County and all its cities, but also adjoining counties and communities. All this is on a wholesale basis. It obtains water, treats it, and sells it to the users. Therefore, standing alone, it does nothing for the consumer. So the water systems of Marietta, and like places, along with Cobb County as a unit,

buy water from the Water Authority and sell it to their individual consumers.

In Public Works for January, 1955, the striking development of DeKalb County was presented. De-Kalb lies to the east of Atlanta, and its water problem became the thin edge on which the life of the county teetered for years. The problem was solved in such a statesmanlike way that DeKalb County is a power today. The method there was different from that found feasible in Cobb County. The two counties are alike in that the spreading of Atlanta, and its increasing demands for space, threatened the corporate life of both.

### History and Build-Up

For basic data to plan a water system, Cobb County has a population today of about 85,000, up from 38,000 in 1940. Marietta has today about 35,000, increased from 8,800 in 1940. Other places in the county are growing rapidly. The county covers 350 square miles. It is foothill country, elevation above 1000 feet, draining into the Chattahoochee River, from which Gainesville, DeKalb County, Atlanta and Fulton County, all draw their water. A steady supply is insured by impounding behind Buford Dam, now under construction.

From a typical rural county, Cobb has become more and more urban and industrial. Farming is important, but changing from field crops to dairying, cattle, truck and chickens. The development of recreational areas proceeds with increasing pressure from the city populations. Famous Kenesaw Mountain and Allatoona Lake are attractions. Banking facilities are being extended from both Atlanta and Marietta. The Georgia Power Company is vigorously alert to its opportunities. Direct telephone servive has been installed between the county and Atlanta; a subscriber can deal as directly with stores and business houses in the metropolis as with local establishments.

The Lockheed Aircraft Corporation re-activated the bomber plant in the Korean War, and re-tooled it to produce B-47 bombers. It now employes 25,000 persons, and has announced that it will keep this plant as a permanent establishment. Adjacent to the plant is the Dobbins Air Force Base on which mil-

 COBB County-Marietta treatment plant, front view. Loading platform at left; treatment units in the rear. lions have recently been spent to fit it for jet aircraft.

### Water Supply Planning

When World War II came, with the construction of the Bell aircraft plant, the preceding sectional planning went into the discard. A 20-in. steel main was built from Atlanta to Marietta which supplied 5 mgd. When the plant closed down this supply was continued. But Atlanta began to tap the main to supply annexed areas on the north side of the city, which reduced the supply to Cobb County to 3 mgd. This was adequate warning to Cobb County that it would have to develop a supply of its own.

In 1950 the county and city jointly retained Merritt & Welker to study the situation and make recommendations. The necessary legislation was passed, and the engineers presented these recommendations:

1. A raw water intake on the Chattahoochee River and a 16-mgd pumping station.

2. A 30-in. pre-stressed concrete main from the river, 7,600 ft. long, to the treatment plant.

3. A treatment plant with initial capacity of 8 mgd, designed for ready expansion to 12 mgd.

4. High-service pumps.

5. About 29,000 ft. of 30 in. prestressed concrete main to the reservoir.

6. A 4-million gallon reservoir on Black Jack Mountain.

7. About 6,800 ft. of 30 in. concrete main to the 4-lane highway which bisects the county, touching near Marietta.

8. Other mains from 8 to 24 in. to connect to the Cobb County, Marietta, Smyrna, Acworth and Kennesaw water systems.

The Authority purchased that part of the 20-in. main from Atlanta within the Cobb County border, 25,000 ft. for \$127,000. The main is to continue in service as a standby, and Atlanta will charge \$175 per month for standby service plus 13 1/3 cents per 1000 gallons of water used.

It was evident that the usual historical statistics on supply and demand would be useless and misleading. Effective history begins with the building of the bomber plant. For a guide to planning from that point the records show total yearly consumption for Marietta in 1945, which was the total for the county, at 497,925,000 gallons. In 1950 the total consumption was 785,-774,000, in which Marietta had 641,-968,000

In the Cobb County distributing system in 1950 there were 1,926 customers using 102,184,300 gallons. These figures rose to 4,408 customers in 1954, using—in the first four months—102,781,000 gallons. Among the subscribers are 53 large customers.

### **Future Planning**

The prospectus for the sale of the \$3,000,000 water bonds presented a critical analysis of the probable growth of the county. It stated that there were already 83 industries besides the aircraft plant, listing furniture, hosiery, cotton garments, lumber, cabinets, thread and knitting. Others are expected to come in. The planning provides for two large customers to be added each year. Past experience shows that 70 percent of the potential customers on a new line become consumers in the first year; and at the end of three years every house on the line uses water.

The City of Austell in the southern end of the county is building a natural gas system, which is bound to spread over the county, adding new stimulus to the rate of industrial and residential growth.





FILTER operating gallery with filters at right. These have Palmer surface wash and are designed to operate at 2 gpm per sq. ft. Capacity of plant is 8 MGD.

A sewerage system is proposed for the more thickly settled parts of the county, made possible by the stabilized water supply. How far this system may be extended depends upon the demand, and upon the restrictions on the use of septic tanks in densely populated areas. The FHA will no longer approve construction providing septic tank disposal.

Housing in general, and near the new industries in particular, is increasing at an accelerated rate, with a profound effect on planning. The Health Service of the Federal Security Agency made its first grant, \$356,000, to Cobb County, accepting it as a critical defense housing area.

So Cobb County is not in a static condition. It is distinctly fluid. It sold \$2,775,000 Water and Sewerage Revenue Anticipation Certificates to finance its distribution system, which now consists of mains along paved roads to serve more than half the area of the county. All the thickly populated sections have been reached. But the 1950 census showed that 56.7 percent of the county population lived in unincorporated areas, so there are many more extensions to be made—and at a higher cost per consumer.

It is expected that work will begin in 1956 to double the size of the treatment plant, as provided in the original plans, to supply 16 mgd.

The rate structure of such a system must be based on hard experience so far as that is a safe guide, and upon careful analysis of demand and probable cost of service. The most important question is: Will the concentrations of industry, with low unit service charges, balance the widely spaced house connections with higher unit costs? The best

judgment has indicated a rise in rates, in gallons, as follows: For the first 2000 gals., from \$2.50 to \$2.80; for the next 4,000 gals., 60 cents per thousand; and for all over 20,000 gals., 35 cents per thousand.

### **Treatment Plant**

Aside from unusually fine planning and construction, the treatment plant is conventional. The administration building and its entrance are beautifully executed. The interior is more like a large laboratory or college than a utility. Light green glazed tile on the walls makes an exceptionally pleasing appearance, with assurance of low maintenance costs. Mottled green tile is laid on the floors. The ceilings are painted white. Fluorescent lighting is installed throughout the building. The pump room is treated in almost the same manner as the filter room and the offices, and the piping is painted a crisp light blue instead of the usual dull black.

In the laboratory, a table runs down the middle of the long room; balances and other equipment are ranged around the walls. One party of women visitors called this the kitchen. Superintendent Bowen has an office here equal to any in a city building, with steel furniture and files. Just off from the office is the filter room and the flash mixing tank. At the far end of the four settling basins are the two mixing chambers, followed by the settling tanks. The filters have Wheeler bottoms and Palmer surface wash. The wash water tank is of pre-stressed concrete, with a capacity of 460,000

In the pumping station on the Chattahoochee River there are two 8-mgd single stage DeLaval centrifugal pumps designed for a head of 270 feet. All pumps in this station, and also in the treatment plant, have Chapman cone valves on the discharge side, and are equipped with Skidmore primers. The discharge lines from the pumping station and the treatment plant have Pelton surge suppressors.

Turbidity in the river is high, reaching 2500 ppm at times, but water officials in the counties and cities taking water from the river expect this content of silt to drop once Buford Dam is completed. The present reservoir is doing a good job of settling out silt, for the water entering the plant is carrying only 55 ppm.

### Pumps and Distribution

The supply to consumer lines is pumped by three DeLavals, direct-connected motor-driven, 8, 4 and 2-mgd capacity; the smallest pump is connected through a clutch to a standby diesel engine.

The cost of treatment plant totalled \$788,916.80 of which piping, fittings and valves amounted to \$105.846.10.

The plan of August, 1954, for the Cobb County Distribution System included \$756,586 for extensions, including two 250,000-gallon storage reservoirs and raising an existing reservoir. The cost of the proposed sewer system is estimated at \$1,-102,579 which includes construction at \$686,405, a 500,000 gpd treatment plant and two pumping stations.

Contractors for the treatment plant, pumping station and electrical line were: Arthur Pew Construction Company, Atlanta; E. W. Bacharach Construction Company, Kansas City; Acme Electric Company, Andalusia, Ala.; and Jordon Construction Company, Marietta, Ga. The supply lines were built by: L. F. Wilder, Birmingham, Ala., and Nichols Contracting Company, Atlanta; the materials were furnished by Lock Joint Pipe Company, U. S. Pipe & Foundry Company and M & H Valve & Fittings Company.

This county-city plan for improvements in the fringe around Atlanta began with DeKalb County, and is now well advanced in Cobb County. Cherokee County, farther away, has recently signed contracts to launch a similar program. For various reasons the economic and living requirements of many counties will move them to follow this lead which is rapidly expanding in Georgia. It reduces the multiplicity of governmental units, and conserves for larger communities the resources of a watershed.

 SPECIAL transits placed at each end of 1,645-ft. baseline make simultaneous observations of aircraft suspected of flying below the legal limit.

### LOW-FLYING AIRCRAFT SPOTTED



### by TRANSIT TRIANGULATION

LEE EICHELBERGER, Supervising Civil Engineer in Charge of Design and Construction, City of Alameda, California

DUE TO the geographical factors in Alameda, Calif., certain periods of weather occur which require airplanes to sweep low over the east end residential district to make a landing at the adjacent Metropolitan Oakland International Airport. As increased air traffic over recent years has caused more and more planes to use this approach pattern, the City Management received numerous complaints regarding the noise. Although legislation exists which prohibits planes from passing over this area below the 500-ft. level, no precise means existed of finding whether pilots were observing this law. Hence the office of the City Manager made a request to the City Engineer to devise some method of checking the altitude of the planes in question. The report of the Engineer's office to the City Manager is quoted herewith as follows:

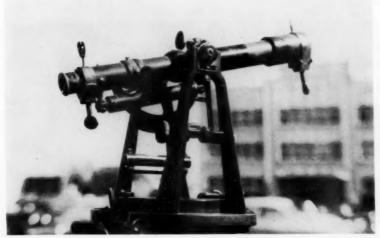
When first directed to determine the method of observing and measuring low flying aircraft on the east end of Alameda, an investigation was made to determine what equipment or instruments could be used for this purpose. The various military services in the Bay Area were contacted and it was determined that the only type of military equipment that was suitable for our purpose was 40-mm. antiaircraft tracking equipment. We checked thoroughly but without success to see if any of this equip-

ment was available. The 90-mm. equipment, similar to that used at a local anti-aircraft post, is not capable of measuring accurately low-flying aircraft but is intended for very high altitudes.

Further investigation was made with various private instrument manufacturing concerns to determine if there was other special equipment available that could easily be used or adapted for our purposes. There was none. Investigation was also made of Forestry equipment for spotting fires and Weather Bureau equipment for following ascending balloons. Again these were not suitable nor adaptable for our purposes.

It was finally determined that we would have to use available equipment, such as a surveyor's transit, to measure the height of low flying aircraft. However, it was found that with the large magnification of the transit telescope, it was difficult to follow airplanes when they became too close. The instrument companies of the Bay Area were again contacted without result in an attempt to determine if any special lenses were available to reduce the magnifying power of the transit telescope.

Sighting attachments for use on our existing transit equipment were then devised by members of the Engineering Design Office. These attachments consisted of a peep sight placed directly above the eye piece of the transit and a knife sight attached to the other end in order to give the same general effect as a gun sight. These attachments were ad-



MODIFICATIONS include sights, reduced magnification and stopping devices.

justed to duplicate the transit alignment. It is believed that, by these sights, accuracy within 10 to 15 ft. can easily be achieved on sights up to 1000 feet.

A base line was then set up on the east end of Alameda with a length of 1.645 feet above which it was judged that the low-flying aircraft would pass. Stopping devices were placed on the transits so that, when following aircraft through the sight attachments, the horizontal movement of the transit would be halted when the line of sight became aligned with the Base Line. The vertical angle on the transit is measured when the transit comes into alignment with the Base Line. By using the measured vertical angles from the two observation stations, a graphical plotting was easily made to determine the elevation of the air-

Aircraft landing at the Oakland Municipal Airport approach the field by passing over the east end of Alameda only during certain wind conditions. The condition exists when there is a southeast wind; and a southeast wind normally precedes and continues during the first portion of a rain storm. Monday, March 29, 1954, was the first day that this southeasterly wind occurred after we had our equipment and base line prepared for measuring height of the aircraft. All aircraft approaching the Airport's southeasterly runway from the period of 1:30 pm to 4:30 pm and from 6:00 pm to 10:30 pm on that day were observed by our instrument op-

During these periods, 17 aircraft were observed, and 13 of these were measured; 4 of the aircraft veered too far north or south of our base line to be measured. Of the 13 planes actually observed, 8 were between 300 and 400 feet in elevation; 2 were between 400 and 500 feet in elevation; and 3 were between 500 and 550 feet in elevation. The lowest plane observed was 320 feet high, and the highest plane 530 feet high, with the average elevation being 417 feet high.

Also attached as part of this report was a diagram of plotted angles from the base line which shows the various positions at which aircraft passed over it. This also shows that there is a definite flight pattern established for the majority of the approach planes where they pass over the base line. Attached also was a similar grid on which was plotted the over-all average position of the aircraft and the average position of the closely grouped flight patterns which more than fifty percent of the aircraft used.

### Lubricated Plug Valves facilitate Sewage Plant Operation

THERE are a good many valves in a sewage treatment plant and a considerable proportion of these have to be opened or closed every day. The sewage treatment plant at Hasbrouck Heights, New Jersey has eased operation problems, according to George H. Eckert, Superintendent, by a maximum use of tapered lubricated plug valves. The trend at the Hasbrouck Heights plant is to use lubricated plug valves whenever old valves are replaced and when new equipment is added.

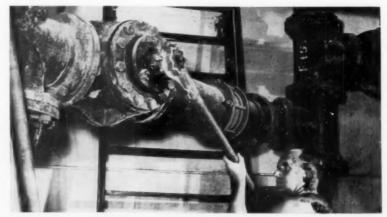
According to Mr. Eckert, there is a tendency on the part of some operators to open a sludge valve only part way, making the pumps work harder and use more power. Also, rags and other solids tend to build up in the partly closed line, in some cases stopping the flow entirely. "This difficulty is avoided with lubricated plug valves because a quarter-turn fully opens or closes them. In addition, with a lubricated plug valve, even if a valve is not used for a long time, a couple of shots of lubricant will unseat the plug enough to make it operable."

The Hasbrouck Heights plant, built in 1938 to handle a sewage flow of 1 mgd, is of the chemical precipitation type. Since the plant was built, the community has more than doubled in population and a

major expansion program was undertaken, beginning in 1954. New equipment recently added includes a new digester and two sand beds. All valves on the digester are Rockwell - Nordstrom lubricated plug valves. In addition to the quick-opening feature, the lubricated plug valves provide the tight closure which is required for a piping system handling gas, conserve space and weight and keep critical seat areas fully lubricant sealed so that abrasive materials cannot intrude.



 LUBRICATED plug valves permit quick isolation of gas flow meter.



 ALTHOUGH lubricated plug valves in digestion tank piping systems may not be used for extended periods of time they are ready for operation without difficulty.

# PROBLEMS IN REBUILDING A SEWER SYSTEM

### C. E. WRIGHT

YEAR AGO, Sanford, a city of A about 15,000 residents in east central Florida, decided that something had to be done with a sewerage system that had become intolerable. Built in 1927, when municipal finances were impoverished by the collapse of the Florida real estate boom, its most objectionable feature was an open sewer, Pump Branch, running for 3400 ft. through the center of the city. This served for both drainage and sewage. In addition to the health hazards involved, plus unpleasant odors, the continuous flow of water, swollen frequently by heavy rains, was undermining houses and polluting beautiful Lake Monroe on which the city is situated.

City authorities, limited as to the amount of money that could immediately be raised by a bond issue, decided upon a two-stage development of a modern system of sewerage, the first stage to correct the deficiencies of the old system and the second to provide a treatment plant. A bond issue of \$1,500,-000 was approved by voters for the first stage. The engineering firm of Robert M. Angas & Associates of Jacksonville was employed to devise a plan by which the antiquated system could be converted at a minimum cost. The bonds are backed by a special sewer tax applied as a percentage of water bills. This tax according to present estimates, will raise from \$30,000 to \$40,000 a year over and above the bond service

and amortization requirements and will afford a basis for financing construction of a treatment plant, now scheduled for completion by March, 1957.

The first step in the program outlined by the engineering firm was to get rid of the open sewer. This was done by converting it from a combined storm and sanitary outlet to a storm sewer only. A corrugated metal culvert was laid using 2500 ft. of Armco 60 to 96-in. pipe and 72 by 44-in. pipe arch. Manholes were of corrugated metal pipe with welded ladder rungs for access.

Twelve outfalls ranging in diameter from 15 to 48 ins., which discharged both drainage water and sewage into Lake Monroe, some of it into the city yacht basin, were left as storm sewer outfalls. An outfall for sewage was built in the northwest section of the city, a 16-in. line of asbestos coated corrugated galvanized pipe extending 1520 ft. into the lake and into 8 ft. of water. This outfall was built inexpensively, as its use may not be necessary after the treatment plant has been completed and is in successful operation.

The sewage outfall line is situated at the point where the new treatment plant will be built. A pumping station on shore, equipped with two 1500-gpm Worthington pumps, pumps the sewage through the outfall in order to obtain the greatest possible diffusion. But first it is put

● COMMINUTOR shreds large solids before sewage enters the outfall line.



• INSTALLING a watertight connecting band on a Pipe-Arch sewer.

through a Worthington shredder, comminutor and bar screen. As an economy measure, Angas & Associates designed a straight flow type comminutor structure instead of the conventional type. By coincidence, the Worthington Corp. had recently designed a new type comminutor, which operates in a half circle instead of a complete revolution, and this was readily adaptable to the simplified construction.

During the few months that this system has been in operation there have been no visible signs of sewage coming back to shore. BOD tests will eventually be made.

In order to separate the raw sewage from drainage water, it was necessary to build an interceptor line 4650 ft. long to collect the sewage from the 12 combined outfalls and take it to the lake shore pumping plant. For this line, vitrified clay, in diameters from 27 to 33 in., was used. Leaping weir manholes were chiefly the answer to the problems of separating the sanitary from the storm sewers. One of these has been placed at each of the 12 old out-

(Continued on page 108)





• REFUSE deposited in sanitary fills is seldom analyzed after decomposition

### GERSON CHANIN

Chief Sanitary Chemist.

East Bay Municipal Utility District,

Oakland, California

### DECOMPOSITION EFFICIENCY OF SANITARY LANDFILLS

NO QUANTITATIVE method has been proposed for the evaluation of a sanitary fill operation to the best of the author's knowledge. The progress of decomposition generally has been followed by a word description of the physical nature of the fill material after some period of burial. In some instances the Biochemical Oxygen Demand and/or solids contents of the decaying matter have been determined and employed in the estimation of the decomposition.

The sewage treatment plant of the East Bay Municipal Utility District collects and treats the sanitary sewage and industrial wastes from six cities located along the east shoreline of San Francisco Bay. These cities include, Alameda, Albany, Berkeley, Emeryville, Oakland, and Piedmont.

Bar screenings, grit, grass clippings, rubbish, etc., have been disposed of in a cut and cover sanitary landfill since the plant began its operations in November 1951. During the months of August, September, and October, fruit and vegetable canning waste solids are present in large amounts in the bar screenings. During the rest of the year the bar screenings are quite ordinary, containing the usual variety of organic debris.

Studies were made to evaluate this landfill method of disposing of bar screenings and grit. Post holes were dug in the fill and "soil" samples representing various stages of decomposition were collected and submitted to the routine sanitary laboratory tests. The results obtained are shown in Tables 1 and 2.

It is evident from the data presented in these tables that very good Table 1—Sanitary Landfill Evaluation Sampled
September 1954

		Total Sulfides	5-Day BOD	Total Solids	Total Volatile Solids	Ash
		Mg./Kg.	Mg./Kg.	Percent	Percent	Percent
Sample	1	184.0	177,000	27.10	19.64	7.46
Sample	2	0.0	195	92.30	0.96	91.44
Sample	3	12.4	16,000	80.30	10.34	69.96

Sample 1—Freshly dumped material; grit, bar screenings, lawn clippings, etc.

Sample 2—Black, dry, sandy material with few identifiable solids; apricot pits, bits of wood and rubber goods; buried early in 1952.

Sample 3—Deep black, lumpy soil with undigested materials; leaves, matches, rubber goods, paper, tomato skins, peach and apricot pits; strong odor of decomposition; buried probably in September 1952.

decomposition is being obtained. This is reflected by the lowering of the BOD, the percentage of volatile solids, the sulfide concentration, etc. It is further indicated that decomposition of cannery waste-laden solids occurs at a slower rate than that of materials not containing any large quantity of cannery wastes.

In order to express these findings more quantitatively, the same sort of reasoning was applied to this process as is employed in the calculation of sludge digester efficiency—that is, measuring the percent reduction in the volatile matter. It may be assumed that two processes occur in the stabilization of these wastes: one is a concentration of the solidadue to loss of water through compaction, drainage, etc.; the other is

a decomposition of the volatile organic solids. It may further be assumed that the inorganic solids, or ash, are not decomposed. Thus the change in the percentage of the ash will be a measure solely of the concentration of the solids.

Therefore, formula 1 will give the percentage of volatile solids if only concentration occurred:

$$VSR \times \frac{AD}{AR} = VSP'....(1)$$

where VSR is the percent volatile solids in the raw material; VSR' is the percent volatile solids in the raw material after concentration only; AD is the percent ash in decomposed material; and AR is percent ash in raw material.

VSR' would be the final concentration of the volatile solids in the stabilized matter if no decomposition occurred. But actually the percent volatile matter in the decomposed solids will be somewhat less than this. The difference is a function of the volatile solids destroyed, as follows:

$$VSR' - VSD = VSX$$
 (2)

where VSX is percent of volatile matter destroyed and VSD is percent of volatile matter in decomposed material. The efficiency can be measured by:

$$\frac{\text{VSX}}{\text{VSR}} \times 100 = \text{E} \tag{3}$$

where E is the efficiency of decomposition, expressed as a percentage. Now substituting in (3) the values given for VSR' and VSX in formulae (1) and (2), and rearranging in a simpler form we get:

$$1 - \frac{\text{VSD x AR}}{\text{VSR x AD}} \times 100 = \text{E (4)}$$

Assuming that the first sample in Table 2 represents the composition of the raw material we may calculate the efficiency of decomposition of the material buried July 1952 (Table 2) by using formula 4. This is found to be 99.15 percent.

Applying similar reasoning to the other samples collected, we find that the samples buried in July 1952, July 1953 and July 1954, with no canning wastes present, show reduction efficiencies of 99.2, 99.7 and 97.6 percent, respectively. The October 1954 sample with canning wastes present showed a reduction efficiency of 49.7 percent; and the September 1952

Table 2—Sanitary Landfill Evaluation Sampled
August 15, 1955

	*	Total Sulfides	5-Day BOD	Total Solids	Volatile Solids	Ash
		Mg./Kg.	Mg./Kg.	Percent	Percent	Percent
Sample	4	114.0	131,000	17.52	14.13	3.39
Sample	5	0.0	4,000	92.10	3.16	88.94
Sample	6	10.5	380	95.64	1.06	94.58
Sample	7	21.5	82,000	46.45	31.45	15.00
Sample	8	34.5	3,450	87.02	7.96	80.06

Sample 4—Material being buried: Grit, screenings, peaches, apricots, rags, grass cuttings, etc., taken from pile to be covered.

Sample 5—Gray to black, fine, sandy material buried around July 1952; no clumps Sample 6—Similar in appearance to above; buried around July 1953.

Sample 7-Buried about October 1953; gray to black color; strong odor of decomposition; clumps of undecomposed solids; rags; fruit pits; paper; tomato skins.

Sample 8—Gray to black soil; faint odor of decomposition; identifiable rags and rubber goods; much less undigested material than previous sample; probably buried July 1954.

sample, also with canning wastes present, showed a reduction efficiency of 96.0 percent.

Thus, it may be concluded that the organic materials disposed of by burial at this sewage treatment plant are generally almost 98 percent decomposed in one year and virtually completely destroyed (99%+) in two years. However, if cannery wastes are included in the buried materials, then only 50 percent composition is obtained in one year and about 96 percent in two years.

The extension of this same line of reasoning into allied fields is almost self-evident. A similar analysis could be applied to a municipal garbage dumpsite, to a composting operation,

or to any similar process in which water removal and biological decomposition occur.

The major technical problem would be that of obtaining truly representative samples, especially of the variegated and heterogeneous solids which constitute the raw materials in these procedures. However, this is not an insurmountable difficulty. Two general methods of approach may be employed:

First, one might collect a composite sample covering some period of time and containing all the types of materials which may comprise the raw material. This is the method employed in these studies.

Secondly, one might sample each type of raw material separately. Then apply weighted averages to the analytical data obtained.

The laboratory procedures employed in these studies are in general similar to those given in the 10th Edition of Standard Methods for the Examination of Water and Sewage. In preparing these samples for analysis it was essential to grind and blend the samples into a homogeneous, representative mass.

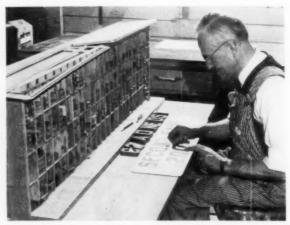
Without the cooperation and assistance of several members of the staff of the East Bay Municipal Utility District, this study could not have been completed. The samples were collected under the supervision of Glenn Davis and Richard Hee, Treatment Plant Foreman and Junior Sanitary Engineer respectively. The laboratory investigations were under the direction of Edward Chow, Senior Sanitary Chemist.



CANNERY WASTES being buried in a sanitary fill. These materials appear to decompose at a slower rate than other refuse samples not laden with cannery solids.



COMPLETED reflective street name signs as they come out of the heat-vacuum applicator. Here examples of the City sign shop's work is inspected by Commissioner Christensen.



APPLYING non-reflective black plastic letters to the white reflective background. In a previous operation the background material was bonded to the aluminum sign blanks.

# CITY-WIDE PROGRAM of REFLECTORIZED Street Name Signs

TWENTY THOUSAND street
name signs in Salt Lake City,
Utah, will be reflectorized in a new
program which ultimately will result in the reflectorization of nearly
all the city's traffic control signs.

According to Joe L. Christensen, street and public works commissioner, the street name signs—black letters on a background of silver "Scotchlite" brand reflective sheeting—will be reflectorized in the city's sign shop established in the room previously used for the assembly of purchased signs. Officials expect to have about 1,000 new reflective street name signs erected in the rapidly expanding residential areas. In time all of the city's 20,000 street name signs will be reflectorized.

Several reasons prompted city officials to reflectorize the street name signs, the commissioner added:

1) Reflective street name signs facilitate the smooth flow of traffic. The nighttime motorist who is forced to slow or stop to read the street name creates an accident-

potential situation. If he is driving in an unfamiliar neighborhood, he may be forced to slow or stop several times before reaching his destination.

2) The reflective street name signs, visible at night from a block or more away, help mark the intersections, whether lighted or unlighted, for approaching nighttime motorists, especially in residential areas.

3) Reflective street name signs are an added convenience for the residential motorist, a good public relations device and an indication of a progressive city for the out-oftown motorist.

4) The changeover was simple. It did not require additional space nor specially trained personnel; existing employees were utilized.

All the reflective street name signs are being produced in a 4-by-6-foot vacuum applicator in which the reflective sheeting is bonded to the metal sign blank. The plastic letters are applied to the surface of the reflective sheeting in the same applicator.

New street name signs will be backed with the 61S-T6 aluminum blanks. Old non-reflective street name signs will be reclaimed and given new reflective faces.



 NEW street name sign is one of 20,000 to be reflectorized in program.

### Muck Stabilizes

### A LOOSE SAND BASE

THE MATANZAS Inlet project consists of 17 1/3 miles of highway rebuilding, with a novel revetment to protect it, and a concrete bridge 1704 ft. long. All the work is being done on A-1-A, a little known road which runs south from Fernandina, the northernmost city in Florida, by-passing Jacksonville, and terminating at the tip of the peninsula below Daytona Beach. The road is built on the continuous sand dune or escarpment which separates the ocean from the Intra-coastal Waterway—by as little as 1500 ft. in some sections.

A-1-A has plenty of historical and scenic importance, hiding its greater value for defense. It was lifted out of obscurity by a group of men in Fernandina who financed the construction of the island-hopping section from their city south to the St. Johns River. It crosses close to the mouth of the river by ferry. It began as a toll road called "The Buccaneer Trail." When it was taken over by the state it came into its own because it freed through traffic around Jacksonville.

In about 70 miles it traverses the area in which France and Spain waged their savage struggle for possession of Florida, with an eye to all the southern territory. Mexico claimed and governed the Port of Fernandina for a time, when it was a thriving base for piracy. The area has flown seven flags: Spain, France, Mexico, The Republic of Florida, England, the Confederacy and the United States.

### A Strategic Section

If we should begin to close highways as a security measure, A-1-A would be barricaded tight as a drum because it connects directly between the numerous bases around Jacksonville and the guided missile base on Merritt Island. Also because it provides for land patrols of the Intracostal Waterway in a strategic section, observation of the mouth of the St. Johns River—which is the key to inland passages behind the

islands off the Georgia coast, and observation of traffic off the Florida coast.

This accounts for the thoroughness with which the road is being rebuilt for heavy traffic. The old narrow penetration surface was broken up and removed. Then the loose sand was stabilized with muck taken from borrow pits on the in-

usual way by spreaders and rolled to grade. As finished the surface is rough-smooth, with excellent traction. The rebuilding cost \$495,854.66, and was done by the Duval Engineering and Contracting Company of Jacksonville.

Revetting of some kind is necessary in this exposed location, for the ocean takes a heavy toll of any



 CONSTRUCTION work on the bridge over Matanzas Inlet. This bridge is 1704 ft. long, 28 ft. wide curb to curb, and is built of reinforced concrete throughout.

land side. The muck is basically marl, somewhat like blue clay. It is a sticky, heavy mass holding considerable vegetable matter, and yields to pressure like putty. Intimately mixed with the sand it bonds the two materials into a firm base. It was worked in by repeated scarifying while subjected to heavy traffic. Stretches under construction were kept open to traffic kept at 10 miles per hour behind flag trucks, and this continuous use of the road by all kinds of vehicles compacted the whole structure as nothing else would.

On this sand-marl base the pavement was laid with a double penetration using mineral aggregate. The courses of asphalt were laid in the change in the face of a dune. The severity of this action is indicated by the almost complete absence of any vegetation, such as normally grows to protect dunes. In bad weather this section has been closed to all traffic by the high waves, thick mist, blowing sand, and water on the payement.

With heavy seas running the whole ridge is in jeopardy, and the road beyond is in danger. Engineers who know dune action take a dim view of trying to stop the destruction of any structure exposed to the ocean. But some protection has to be provided. So the state maintenance department devised a method of using the concrete slabs which were broken up when U. S. High-



• OCEAN side of the bridge. Tides rip through the inlet at high velocity.

way #1 was rebuilt through Daytona Beach and Holly Hill.

This waste concrete had been piled along the river. The slabs ranged from pieces six feet across down to one-man chunks. It was loaded with a portable crane into trucks. Some of the loads were tremendous, and they all traveled the full length of the new pavement in all stages of construction. Another portable crane unloaded the slabs along the road shoulder. A bulldozer dug a deep ditch on the ridge, just inside the outer top line. When a section of the ditch was opened as deep as possible, the crane picked up slabs and lowered them to stand on edge. None was wide enough to reach to the top of the ditch, so successive slabs were built up to make a fairly tight wall. Sand was then bulldozed back against this wall from the ocean side. Loose chunks were piled over the top, to be settled down by wind and wave

Even if wave action washes some of the sand out from the wall, wind will carry it back. If water cuts under, the slabs will settle, but very likely retaining their relative positions. The top of the revetment is higher than the ridge was before.

Other types of protection have failed. A rigid wall is undermined and cut out behind its back. Piling with planking on the face fails in about the same way. Palm tree trunks have been laid up horizontally and fastened with stakes and spikes, but they are either washed out or torn apart. The more this revetment with slabs of concrete is

compared with others the more likely it seems that it will keep its form, even though disrupted and settled down again.

### The Bridge

The bridge over Matanzas Inlet is 1704 ft. long, 28 ft. wide between curbs, with a 31/2-ft. sidewalk on either side. It is reinforced concrete throughout, on concrete piling. The design loading is H-20-44. There are 48 bents, with spans of 36 ft. generally, and a wider channel span. Through 28 spans the bridge floor is level at El. 17, sloping off to 14.35 at the south end and to 13.32 at the other end.

There is no provision for large boats to pass through the channel, but a 40-ft. opening is protected for 100 ft. of travel under the bridge by fenders of piling faced with timber planking. Each end of the bridge is based in a bulkhead extending back along the road for 240 ft. on one side and 145 ft on the other. The bulkheads are constructed of precast concrete members, with Yshaped anchors back into the sand, and faced with precast sheet piling. Navigation lights on the ends of the fenders will be turned on at sundown, and off at sunrise, by a photoelectric operated relay.

The State Road Department set up a batching plant at the north end of the bridge, installing a Smith one-half yard mixer in a bin-andbatch system. Three mixes were made, all air-entrained. On a onebag basis they were: For piles and caps - high-early-strength, 172# sand, 314# stone, 5.8 gallons water

and 11/2 oz. Darex. For everything else except rails-vibrated; 169# sand, 324# stone, 5.5 gallons water and 1 oz. Darex. For rails only non-vibrated; 177# sand, 311# stone, 5.7 gallons water and 1 oz.

Pile driving began on February 8. 1955. It was expected to jet the piles to within the last four or five feet, and then drive them to refusal. This worked until a bed of shell was encountered, hard enough to stop penetration by jetting, and so porous that it absorbed the force of the water. So it was necessary to drive

the piles through.

Another unusual difficulty turned up in the jetting. The fixed end of the jet assembly was 4-in. pipe. When the assembly was to be withdrawn the fine sand settled in so quickly and firmly that the rig was pulled out only with a lot of trouble. A one-inch air jet was fastened to the outside of the 4-in. pipe, and directed to hit under the end. When the assembly was to be withdrawn the air jet was turned on under high pressure. It loosened the sand and stopped the trouble.

The floor of the bridge is deck girder construction with caps on the piles 2.5 ft. deep and 3.0 ft. wide. Between bents the system consists of four girders, 3.0 ft. deep from the surface of roadway. The two middle ones are 191/2 ins. wide, and the two outside ones 16 ins. wide. Steel for the girders was pre-fabricated and set in place in the forms. Steel trusses slung underneath supported

the forms.

The road slab is 7 ins. thick, with a crowning slope of 3/16 in. per foot from center to curbs. Sidewalks are cantilevered, integral with the girders and road slab. Rail posts, 10 x 12 ins. are cast in place over steel anchored in the walk reinforcing. Two rails are embedded in the posts, with their ends wrapped in heavy paper to prevent bonding.

The cost of the bridge is \$383,-088.59, and the contractor is Cleary Brothers Construction Company, of West Palm Beach, Florida. E. K. Martin is Project Engineer for the State Road Department on both the highway rebuilding and the bridge.



## Microfilming Deeds and Records Simplifies City Map Changes

C. LELAND WOOD,

City Manager,

Watertown, New York

TO UNDERTAKE a street and property survey of all parcels of land within the City limits, the City of Watertown, N. Y., many years ago authorized an expenditure of \$10,000. The work was to be done by contract.

After much delay, it was determined that the contractor would be unable satisfactorily to finish the project and it would be more feasible for the City Engineering Department to complete the job. The City Engineer proceeded to assemble all available old maps and other data to permit the completion of land title searches in the Jefferson County Clerk's office. About 13,000 deeds were viewed in checking titles of properties in the city. The change of titles in each instance was foilowed through prior owners for at least 25 years. From these data, large scale maps were plotted for ease of analyses in determining street and property lines.

Survey parties were organized to locate all physical evidence on the ground, monument street lines, establish property boundaries and prepare maps for assessment use. The City was divided into control districts which were subdivided into sections of a convenient size for normal use. The section sheets are 21 ins. by 30 ins. in dimension, bound in loose-leaf form for ease of handling.

The original tracings are stored in a fireproof vault. One set of books is available for public use in the Engineering office; and a second set is located in the Assessor's office for ready reference; and one is in the Drafting room. Many people including engineers, lawyers, real estate brokers, abstract and title representatives visit the City Engineer's Department to obtain property information.

Each year as transfers of property are made which involve a change in property boundaries, the Engineering Department revises the maps so that they are kept up-to-



MICROFILMING unit at County office copies pertinent records for City use.

date at all times. When necessary, small portions of a sheet known as patches, drawn to scale, are prepared and cemented on the proper location. After a number of revisions have been made on a sheet a new one is prepared to replace the old one.

The project extended over a period of several years and was finally completed in 1929 at a total cost of nearly \$150,000. All street lines were reference-monumented, approximately 1500 such markers being installed.

After the maps were completed, an agreement was made with the County Clerk's staff to furnish copies of all deeds of property transfer in the city. Members of the

County Clerk's organization rendered this service on their own time at the City's expense. The City paid on quarterly invoice \$125, a total cost of \$500 per year.

Copies of each deed were furnished on the standard size page of the County Clerk's record books. The Assessor's Department filed each deed in a loose leaf book, maintained an index and stored them in its fireproof vault. During the past 25 years, the accumulation of these records now occupies most of the average number of deed transfers has been about 750 each year.

Inasmuch as the total amount paid for deed copy service each year was not large, the county



FILM READERS are used in the Engineer's office and drafting room.

clerk's employees were paid by a check made out in favor of one person. Several years ago, when the New York State auditors made their routine investigation of the City's records, they criticized this method of payment. It was recommended that the County Clerk's stenographer be placed on the City's pay roll which would have resulted in a small sum per week. The County Clerk objected to such a plan and the City felt that the change was not necessary. The County official finally decided that the City must pay the County direct at a rate of \$1 per page which would have resulted in a decided increase in cost to the City.

Due to the increased cost of deed copy service and a shortage of record storage space, it became imperative to find a new method of maintaining real estate title transfer records. The wide use of films for permanent records, the small storage space required, the convenience in handling and comparatively small cost, favored the film record method.

Several months of delay was experienced in conferences with the County Clerk regarding operation details and the consideration of the best type of equipment to be purchased. It finally was decided to order Recordak microfilming units consisting of one Model J.C. 16-mm. Microfilmer and one film reader with accessories at a cost of approximately \$850 delivered.

Space was provided at the County Clerk's office for a table to serve the microfilming machine. The film reader is located in the Assessor's Office in the City Hall. Once a week one of the Assessor's Department staff visits the County office, checks the deed record book and photographs each page containing a transfer of property within the City. When a sufficient number of recordings have been filmed, a portion of unexposed film is wound upon the receiving spool, to protect the used part which is then cut off and mailed to the manufacturer for developing. The processed film is returned within a few days, placed in the film reader unit whence the desired information is noted from the enlarged film images on the viewing screen so that the proper changes may be made in the assessment records.

The Engineering Department has adopted the above method of viewing deeds for record and map changes. A second screen unit was purchased and placed in the Drafting room for convenience.

An index is prepared to compare with the number assigned to and placed on the deed when it is photographed. Films are filed in special compartments in the vault and may easily be reviewed at any later date if necessary. Enlargements from the film may be made at any time at a nominal cost or a duplicate film can be made for storage at another location for protection in case of emergency.

The film record appears to be equally good whether it be a reproduction from an original record or from a photostatic copy.

The equipment is simple in operation and based on a few months' experience, gives more satisfactory service at a lower annual cost than with the previous plan. The saving in cost through use of this plan has paid for the equipment in one year.

In this instance, what appeared at first to be a more difficult and costly operation resulting from what was deemed unwarranted interference by others, has proven to be advantageous to the City. As the need appears other City records will be filmed and filed for future reference.

#### Rebuilt Sewer System

(Continued from page 101)

falls, now used only for drainage. In dry weather all of the sewage is discharged to the interceptor, and in extremely wet weather the flow of drainage water is so heavy that the effect is minute compared with that from the old system. To have achieved complete separation of sewage from drainage water under all circumstances was not possible with the amount of money available.

As the sewage outfall is in another section of the city from the outfalls formerly used, it was necessary to reverse the flow of sewage in the northern part of the city. A



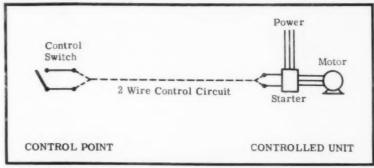
■ LIMITED headroom in some places required the use of metal Pipe-Arch.

central lift station, equipped with one 1000-gpm and one 500-gpm Worthington pumps, receives the flow from outlying sections. From this lift station to the sewage outfall the flow is by gravity. At some points in the city the elevation is up to 55 ft., while at the lake shore it is 8 ft. above sea level.

Old concrete lines from 15 in. to 36 in. diameter, laid 28 years ago, were found to be in good shape and were left down, but smaller lines, with thinner walls, had deteriorated in some places to such an extent that they were replaced with new lines of vitrified clay.

One of the unique problems, however, in the sewer conversion job was an old brick box or vault, 5 ft. wide and 35 ft. long, in the business section of the city. Oddly, no one has been able to explain why this contraption was made a part of the old sewer system, as it apparently performed no useful function, but on the contrary acted as a septic tank. However, to have removed it entirely would have been an expensive operation, as it had four influents and one effluent for sanitary sewage. Thus Angas & Associates had to plan on leaving it in place, but correcting its objectionable features. This was done by reversing the invert so that sewage which collects in it is taken out through the bottom and discharged promptly into the sewage collecting system.

## REMOTE



• ELEMENTARY remote control system provides on-and-off function for motor.

#### IN WATER WORKS OPERATIONS

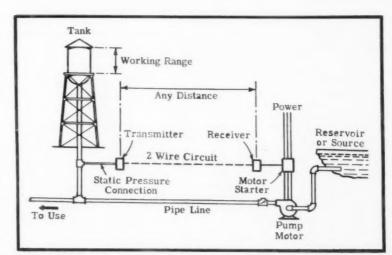
#### B. L. SOSCIA and M. E. ROGERS

A paper presented in Sept. 1955, at the Michigan Section Meeting, Flint, Mich., by B. L. Soscia, Development Engineer, and M. E. Rogers, Project Engineer, Builders-Providence, Inc., Providence, R.I.

WATER WORKS system con-A sists of a source of supply, treatment plant (if required), pumping plant (or gravity flow) and distribution system. By the very nature of this necessary arrangement, all water works systems are spread over considerable area. The larger the community served, the greater the distance between the various parts of the system. Reservoirs for ground water supply and well fields may be at some distance from the treatment and high service pumping station; and outlying sections of the distribution system may require elevated tanks or booster pump stations to maintain the required pressure.

With operating units at various locations in a system, it is generally desirable and frequently necessary to be able to correlate the operations of one area to another and to control operations at one point from another point some distance away. For this purpose, some form of remote control system is used.

Remote control is applied to the following functions or operations: (1) Flow rates in main distribution lines, raw water supply lines, well discharge, etc.; (2) Levels in reservoirs, (both raw water and distributing); (3) Pressure in distribution systems; (4) Pump valve and circuit breaker operations; and (5) Chemical feeder rates.



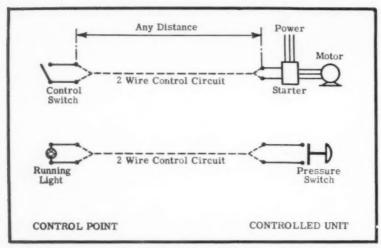
 A TYPICAL application of remote control needs for water works is illustrated by an elevated tank in which water level is maintained by a remotely located pump.

The most common application is that of pump control, and this article will deal mostly with that subject; but the principles involved and explained are also applicable to other water works operations.

#### Types of Control

Remote control in water works systems may be of two general types: automatic or manual. The automatic type of control may involve a simple pressure switch to control the operation of a well or single pump (1) (2); or it may involve a very elaborate system of fixed or variable speed pumps operating on the pressure-flow principle. (3)

One of the most commonly used methods of automatic control of pumps is by means of telemetering a tank or reservoir level to a receiving mechanism equipped with suitable control switches for each pump. In this system a direct pressure or a float operated transmitter at the tank provides a time impulse signal whose duration is directly proportional to level. This type of transmission employs a two-wire circuit and is not affected by normal supply voltage variations or variations in line resistance or impedance. It has the advantage that accurate registration is automatically resumed upon restoration of power, in event of failure. A receiver mechanism is customarily equipped with a recording chart and a group of adjustable glass enclosed mercury switches is provided to control the cut-in and cut-out point on each pump. This type of control is quite simple in operation and adjustments for changing conditions or equalizing wear on pumping units may be made readily.



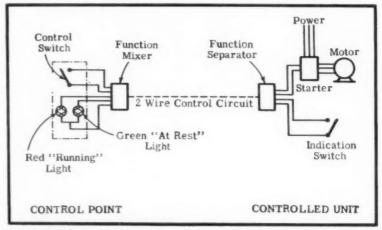
SUPERVISORY control is provided by the addition of a "report back" circuit.
 The running light is actuated by a pressure switch mounted on the pump discharge.

The manual remote control system in elementary form consists essentially of a control switch and a two-wire circuit and relay by means of which a pump can be started or stopped. The control lines may be privately owned or leased from the local telephone company. Such a system is satisfactory but it does not assure that the pump has been started when the selector switch has been moved to the "on" position. To be certain that the pump has started, it is necessary that a reportback function be added. This reportback may take the form of a telemetered quantity such as flow, pressure or level; or it may be pilot lights to indicate that the pump is at the "running" or "at rest" operating condition. To be of value, the report-back indication, regardless of form, must be positive and not inferential. In other words, a contact on the pump motor starter, a pressure switch in the pump discharge line or a limit switch on the discharge check valve must be closed to initiate the report-back function when the lamps are used.

#### Supervisory Control

With report-back, the system becomes one of "Supervisory Control," which is defined by the American Standards Assn. as "a system for the selective control and automatic indication of remotely located units, by electrical means, over a relatively small number of common transmission channels."

The addition of a report-back function requires either more wires or circuits between the control station and the remote substation, or the use of special supervisory conpulse type, in which both remote control and supervision have signals in the form of short electrical pulses, somewhat similar to those obtained in telephone dialing. In this system it is recognized that a short pulse of electrical energy can be duplicated easily from external sources. Therefore, it is required that the remote-location equipment transmit an equivalent grouping of pulses back to the controlling station, as a "checkback" to provide minimum protection against false signals. The second system is composed of a sequence or combination of audio-frequency tones, which provide not one check back feature as in the impulse system, but six different checks before an operation can take place. Such audio-sequence type of control has all remote control signals composed of at least "three (usually four) au-



 BY MEANS OF a function mixer and function separator a common circuit may be used for both control and indication or transmission of two telemeter functions.

trol equipment when several control and report back functions are to be handled over a single pair of wires. For control over a single pair of wires of a pump or valve and report-back of condition by means of a lamp, a two-function "supervisory" system is available. (4) Such a system, utilizing no moving parts and dependable in design, can also be used to report back two alarm conditions or to transmit two telemeter functions or variables in the same or opposite directions over the same pair of wires.

For more elaborate systems involving the control of a number of pumps, combinations of pumps and valves and/or including telemetered functions, other types of remote control or supervisory control systems are available. Two proprietary types have been previously discussed. (5) The first of these is the im-

dio frequencies transmitted one at a time in a definite sequence." $^{(5)}$ 

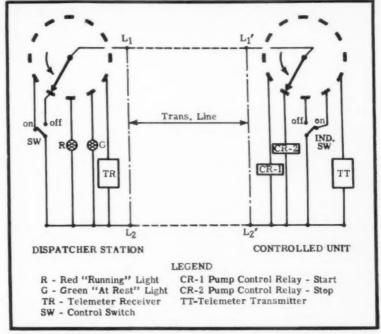
A third type, operating on the continuous scanning principle, is now being used for these applications. (6) This system may be used with private or leased wire circuits and the circuits may employ audio, radio carrier or microwave links.

Essentially the scanning system consists of a motor-driven commutator, or rotary selector at each terminal location, both operating in synchronization. Each commutator contains a number of contact points, each of which is used for a different control or telemetering function. The commutators or rotary selectors rotate at a constant speed of 1 rpm driven by synchronous motors. In this manner a large number of control points are available to start and stop pumps and to open and close valves; also, any number of tele-

metering functions may be monitored continuously. Each control function is checked or "supervised" once every minute so that the dispatcher at the central station has up-to-the minute information displayed on his control panel as to the operating condition of the various units at a remote point.

A control-indicating escutcheon is provided for each control unit. This escutcheon contains an "on-off" selector key, a red "running" lamp, a green "at rest" lamp and an amber "disagreement" lamp. Operation of the selector key energizes the particular commutator bar associated with that control function. As the brush engages the respective commutators, so as to complete a circuit over the connecting lines, a relay is closed at the sub-station end to start or stop the pump, as the case may be.

The sub-station control relay is held in through its own contacts and remains in that condition so long as the dispatcher key remains in the "on" position. An auxiliary contact on the motor starter, a discharge line pressure switch or a limit switch on the check valve closes when the pump is started and in turn completes a circuit through the sub-station commutator bar, over the connecting lines to the dispatcher's scanning unit where an indication relay is locked up to energize the lamps showing the running condition of the pump.



 SCANNING SYSTEM used in one type of multi-function mixer and separator has two rotary selectors driven by synchronous motors to provide many control points.

When the dispatcher's key was originally operated, a disagreement light is displayed to indicate that a control "command" has been given but has not yet been fulfilled. When the report-back indication is received the disagreement light is extinguished. In the event of a

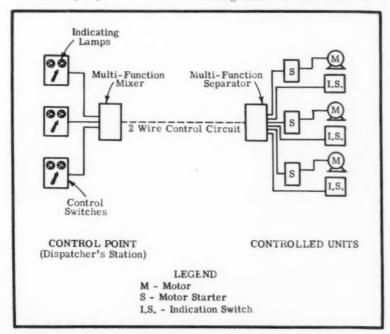
faulty or non-authorized control function the disagreement light is again displayed calling the operator's attention to the unauthorized condition of the controlled unit. Any improper operation such as loss of power at the sub-station, failure of the sub-station motor control equipment, or a shorted or open line will cause a disagreement light to be energized. An alarm system may also be incorporated along with the disagreement light so that an audible signal will be available.

In initiating "on-off" or a combination of control functions, the dispatcher may operate as many selector keys as is desired. When several keys are operated at one time, the associated control functions are performed in succession, one after the other, each in its proper turn as the synchronous scanning units progress through their revolution. Similarly the report-back functions are indicated in succession as the control units assume their proper operating condition.

#### Synchronization

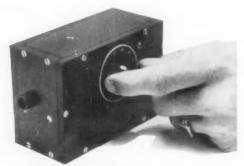
Obviously in a system of this type it is possible to have power interruptions at either the dispatcher's end or at the sub-station end. When this occurs, both units stop simultaneously, thereby preventing any false operation. When power is resumed, both units start rotating

(Continued on page 139)



 MULTIPLE control and indication functions arranged for transmission over a common circuit provide supervisory control for a battery of pumps or other units.

## A SIMPLE METER



### for Radioactive Fallout

THE Atomic Energy Commission has recently announced that detonation of nuclear weapons close to the surface of the earth may result in the dispersal of radioactive dust over a large area. This "fall-out" may be of very high initial gamma ray intensity but decays reasonably rapidly over a period of days or weeks.

It was felt desirable to design a simple and inexpensive dose rate meter for gamma rays which could be widely distributed and which would cover the range of radiation intensities of interest under these conditions. There are several reasons for having such a device. First, there is the problem of the choice of shelter in which to wait until the radiation intensity decreases. Even in a single building there may be considerable variation in radiation intensity from spot to spot so that a meter would aid in choosing the most

advantageous area. Second, such a meter would allow one to determine when it was safe to evacuate to an uncontaminated area. Third, it would aid in preventing panic in regions where there was no fall out or where the amount was negligible and below the danger level.

Crystals of cadmium sulphide were chosen as detectors because of their high stopping power as solids and the fact that their current yield is higher than that for any other known solid. Suitable mounted crystals are available from a number of manufacturers.

The CdS crystal is connected in series with a battery and a current measuring device which consists of a condenser shunted by a neon lamp. Under irradiation by gamma rays the crystal passes current which charges up the condenser to the firing point of the neon tube. After the tube flashes the condenser charges

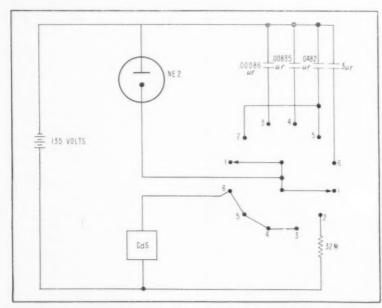
again. Thus the flash rate of the lamp is an indication of the gamma ray intensity.

A model of this meter has been constructed and tested. Range changes are simply provided by switching in condensers of various sizes. In the circuit of Figure 1 condensers have been chosen to give a flash rate of one per second for a dose rate of 1 Roentgen per hour in switch position 3, 10 Roentgens per hour in position 4, 100 Roentgens per hour in position 5, and 1000 Roentgens per hour in position 6. Since the flash rate is approximately proportional to the gamma ray rate, one flash in ten seconds on the most sensitive scale corresponds to 0.1 Roentgen per hour. The overall range of this model, then, extends from less than 0.1 Roentgen per hour to over 1000 Roentgens per hour.

In the model described, switch position 2 substitutes a resistor for the crystal so that the neon tube flashes at a rate of one per second for batteries in good condition. This serves both as a battery check position and as an indicator to the operator of the length of a second. The current drain from the batteries is quite small under all conditions so that the life of the batteries should be their shelf life.

A principal consideration in the development of the design described here was to maintain sufficient simplicity so that the cost of an instrument of this sort might not be excessive either for the individual purchaser or for agencies interested in the purchase of large numbers. The cost of the components of this model, exclusive of the lead shield and the plastic box, was \$6.80.

The above data are from Naval Research Laboratory Report 4571. Complete copies of the report are available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., and are identified as their document PB 111694



• FIGURE 1, circuit diagram of the meter. Complete assembly is shown above.

# SOIL STABILIZATION by Pressure Grouting

#### F. E. GRUNDLER

Director of Public Works

Columbia, Missouri

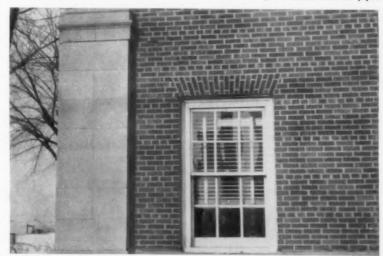
HE SOUTHWEST corner of the Municipal Building at Columbia, Missouri, had been settling for several years until soil stabilization by pressure grouting was undertaken recently. The building, an attractive brick structure, was built in 1932. The footings are relatively shallow, about five or six feet below the ground surface. Settlement of the corner, which increased with time, resulted in a 3/4-inch horizontal crack below the second floor level extending through the brick wall for several feet from the building corner. The interior walls did not settle and a cantilever action restrained the wall above the second floor from settling. Settlement caused considerable damage to the building, including the cracked wall, broken plaster and sheared water and steam pipes.

Local contractors proposed excavation and underpinning the wall to stop the settlement. This is a difficult and expensive procedure. Since the cause of the settlement was believed to be insufficient wall footing area for the bearing power of the foundation soil, soil stabilization by pressure grouting was suggested as a means of correction.

For this work, a Koehring No. 10 Mud-Jack was rented with a purchase option from the Allied Equipment Corporation of St. Louis. The regular City Street Department employees, though inexperienced in the operation of the Mud-Jack, soon became skilled in its use and did all the work in connection with repairs to the building. In order to familiarize the crew with the operation of the machine, a less complicated project was first undertaken. This consisted of stabilizing the soil at the foundation of a wall at the Municipal Airport repair hang-



 SETTLEMENT of the foundation resulted in this 3/4" crack in the wall of the Municipal Building at Columbia, Missouri. Interior damage included sheared pipes.



SOIL stabilization by Mud-Jacking raised the affected corner of the building.

For the second project, the repair of the Municipal Building, the following equipment was used for pressure grouting: Mud-Jack, concrete mixer for preparing the mud slurry, air compressor and tools for drilling concrete slabs, two- and four-inch earth augers, pipe wrenches, shovels and a truck.

The following procedure was used to restore the building. A series of four-inch diameter holes, spaced four feet on center, were drilled with a hand auger to a depth of ten feet in the soil. At this point they were four or five feet below the bottom of the wall footing. These holes, twenty-one in all, were located two



MUD-JACKING crew on the job in Columbia, Missouri. Operations shown here consisted of raising 3500 sq. ft. of sidewalk which had been constructed above a utility trench. Two-inch holes were drilled in the walk on 5-foot centers and a mud slurry containing 10 percent Portland cement was pumped in to fill the voids resulting from soil settlement.



● CONNECTIONS used for pressure grouting. Vertical embedded grout pipe is topped with air vent pipe and globe valve. Two-inch pipe connections arranged for flexibility lead to the Mud-Jack. A check valve located in this line near the grout pipe allows higher pressures to be developed for jacking. Steel pipe was found to be most satisfactory.

feet from the building wall and extended each way from the point of failure. A two-inch diameter steel pipe ten feet in length was then placed in each hole and encased in concrete. The concrete was allowed to harden for a few days to provide anchorage for the grout pipes. Next a mud grout was prepared and pumped into the subsoil through the grout pipes. The mud grout consisted of air-dried clay screened through a 1/4-inch mesh to which was added 20 percent Portland cement, 10 percent hydrated lime and water to make a soupy mixture. About two cubic feet of the mud was pumped into each hole in turn and the grout pipe was capped. The mud was allowed to set for a few days and the pumping was resumed with the cement content increased to 30 percent. After each pumping it

was necessary to auger the hardened mud from the embedded grout pipe before it was possible to start the flow of mud into the subsoil again.

Ten cubic yards of mud was pumped into the foundation area without evidence of it appearing on the surface. As a result, the corner of the building was raised one-half inch by the mud jacking and the balance of the crack was filled with mortar. A section of the basement floor at the northwest corner of the building was raised by mud jacking three-quarters of an inch to restore it to the original floor elevation.

The cost of this repair is estimated to be about a third as expensive as restoration by other methods. On the rented Mud-Jack, the first rental payment was to apply to the purchase price if the City

decided to buy the machine before the second monthly payment was due. At the end of the first month's use it was apparent that with the amount of work to be accomplished it would be advisable to own the machine, and so it was purchased. The cost of the machine over other methods of repair was saved in the first month of use.

Soil stabilization by pressure grouting is a practical and economical method for correcting inadequate bearing power of the soil and restoring structures in cases similar to the one described above. In addition to building repairs the MudJack has been used for raising sidewalks and pavements over utility lines where the earth fill has settled. The machine is now used at intervals as needed and where needed it is a valuable tool.

#### WATER MAIN LEAKS MEAN TROUBLE

#### GERALD WYKOFF

OST COMMUNITIES when faced with a water shortage because of a protracted dry spell or the like have a tendency toward two reactions. First, they follow the sometimes expensive method of having more wells drilled or of increasing their reservoir capacity. If this fails, the next step is usually to impose "restrictions" on the uses of water.

Telford, a small community in southeastern Pennsylvania, found neither of these two methods capable of solving its annual water shortage problem. Despite the presence of two of the highest producing wells in the area, water customers were still forced to contend with the usual restrictions year after year. This state of affairs may have gone on indefinitely had not officials of the town council decided to attack the problem from a different angle.

As a result they hired engineers of The Pitometer Associates to make a water waste survey of all main water lines in the borough.

In the spring of 1955, Pitometer engineers, with the help of borough employees, spent two weeks testing the main lines. Working during the night hours, they checked approximately seven and a half miles of water mains ranging in size from four to eight inches. The survey also included some 34" laterals and

about 1,000 feet of old, abandoned 3/4" to 2" lines, which sometimes were utilized as a tap-in for newer lines. As a result of the survey and remedial measures, water customers in Telford were free of all water use restrictions, even during this past summer's driest period; pumps were in operation only half as much time as was required for the same period in previous years, and wastage of between 75,000 and 100,000 gpd was prevented. Significantly, savings to the borough in costs and maintenance have been estimated at approximately \$7,500.

This initial survey was responsible for the discovery and repair of five leaks which were losing about 77,000 gallons a day. These leaks ranged from minor size to broken-

off 3/4" pipes.

"The repairing of these five leaks alone made it possible for us to invoke no restrictions on the use of water this summer," said John Hoishik, executive-secretary of Telford Borough. "Townspeople went right ahead watering their lawns and washing their automobiles during the long dry spell, yet we saved from a third to a half as much water as was pumped last summer. And the cost of that survey ran less than \$1,000."

The engineers provided the technology, Hoishik pointed out, and borough workers made all repairs. In most cases, repairs consisted of cutting out the defective piece of pipe with a torch and in-



 HYDRANT receives thorough check as William H. Swartz listens for the tell-tale sound of underground leaks.



 MEMBERS of the Telford Borough inspection team run a test on a water main which lies beneath the railroad tracks. Here John A. Long is using a Geophone.

serting a new cast iron section. This type repair was followed for splits and holes. A repair sleeve was used where the line was completely broken off and copper tubing was used for lateral repairs.

So impressed were they with the results of the survey that members of the town council agreed to make a continuing study of the borough's water system. In the months following this auspicious start, borough employees, with their own equipment, inspected the lines between the main lines and curb stops, plus the service lines leading into individual homes. Working with a Geophone, workers discovered and repaired more than twenty small leaks in the follow-up survey.

The borough purchased the Geophone for its own use at Pitometer's urging. A new sonoscope was also purchased for this follow-up. Borough employees learned how to use the devices from working so closely with the engineer on the initial survey.

"It's been years and years since these water lines were ever checked," admitted Warren H. water authority. "As a matter of Fenstermacher, chairman of the fact, they have never been given a really thorough check until now."

In addition to checking the water lines, the borough has now begun the conversion of old water meters in the homes for newer and more accurate ones. A Neptune testing bench has been purchased for this phase of the work. Incidentally, in many cases when a water customer reports a faulty meter, a leak in the customer's line has been found.

The continuing study will be accomplished by periodical spot checks, Hoishik explained. "It's merely a matter of maintenance now," he said. "Whenever a questionable area develops or there's a large spot, we'll get in there fast and test the lines. The way we're set up now, we can quickly handle any unusual situation." To secure the gains which have already been realized, a supplemental statistical program has been initiated to ascertain any sudden water losses in the future.

"As a final safety measure toward beating the water problem in this borough," Hoishik related, "a third well has been drilled. When it was tested recently we were still getting 225 gallons a minute after 48 hours of straight pumping."

This third well, however, was drilled to meet the anticipated new demand for water from people who will be moving into some of the new housing developments now under construction.

"Naturally, we expect a considerable increase over our current population of 2,500," Hoishik said, "but I think we can meet the water needs easily enough. At least," he concluded, "we aren't planning any restrictions for next summer."



#### OF STATE HIGHWAY DEPARTMENTS

TO KEEP HIGHWAYS safe and efficient, entrances and drive-ways, whether commercial or residential in type, must be so designed as to afford safe entrance and exit for vehicles. In this article, the editors have summarized the rather complicated requirements of three states, widely scattered in location, in order to provide a picture of normal requirements.

North Carolina requires that any applicant desiring to construct a driveway or driveways connecting with any State highway should apply to the District Engineer who is in charge of highway maintenance in the county where the property is located. No work shall be undertaken on the State right-of-way until the approved copy of the application has been received by the applicant.

Width of Drive—The width of driveways will be a maximum of 50 feet measured parallel to the roadway or a width equal to one-third of the lot frontage. In the event that the lot frontage does not permit two usable driveways with one-third lot frontage, then one combined entrance and exit with a maximum width of 30 feet shall be provided.

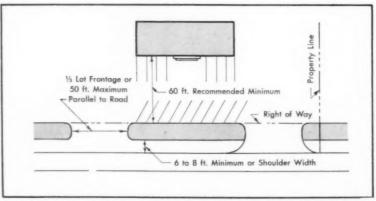
Angular Placement of Drives—The angle of driveways shall not be less than 45 degrees with the edge of road, except that on dual highways, where there is a median strip, the entrance angle may be decreased to 30 degrees. Exit drives onto dual roads shall have an angle not less than 60 degrees with the highway payement.

Filling Station Pump Island—If serving of vehicles is desired on both sides of a pump island, then it is recommended that pump islands be

placed a minimum of 12 feet back of the right-of-way line.

Area Between or Adjacent to Driveways—The frontage on the highway right-of-way, other than that of the driveway itself, will normally be in the form of a ditch. Modifications may be permitted,

Corner Island—At rural intersections, where no provision has been made for sight distance or clear vision areas, no driveway will be allowed in the area between the edge of the road and the right-of-way line for a distance of 25 ft. from the intersection of right-of-way lines



TYPICAL ENTRANCE arrangement for a rural commercial establishment fronting on a highway. This drawing is adapted from "Minimum Standards for Entrances to Highways" of the North Carolina State Highway and Public Works Com'n.

provided proper drainage is furnished and curbs and posts or other safeguards are installed to prevent misuse.

Island Areas—The length, width and shape of island areas may vary for different locations.

Corner Sight Areas—At intersections, where sight distance or clear vision areas have been obtained, no driveway shall be permitted to cross such areas. The driveway at the right-of-way line should begin at a point no closer than the intersection of the sight distance line and the right-of-way line.

measured along the major route and 20 ft. from the intersection of right-of-way lines measured along the minor route. An exception to the above is in urban areas where the corner restriction may be reduced to 15 ft. on both sides of the intersecting right-of-way lines.

Property Line Offset—All driveways shall be so located that the flared portion adjacent to the traveled way will not encroach on adjacent property. A minimum distance of 5 ft. should be reserved between driveway and property line.

Drainage-The drainage in high-

way side ditches shall not be altered or impeded and the applicant must provide suitable drainage structures at entrances and exits at his own expense.

The requirements of traffic movement and the custom-established right of land service are matters which are not readily reconciled. These are often in direct conflict. Highway Departments find themselves to be the "middle man" in the conflict between the rights of highway users and the rights of abutting property owners.

The most common objection experienced to compliance with standards is in regard to driveway widths. Many complaints concerning insufficient width of entrances arise from the fact that some commercial establishments attempt to do business on an insufficient frontage; the trouble is not the width of the entrance but rather that it cannot be properly located without encroachment on adjacent property.

California has the following regulations for standard driveways to serve property fronting on State Highways outside the limits of incorporated cities:

Rule 1—All driveways between the curb line and property line shall be constructed of Portland cement concrete, except where another type of paving may be permitted under other sections of the rules.

Rule 2—Slope areas shall be finished with a push broom.

Rule 3—Scoring lines shall correspond with scoring lines in the adjacent sidewalk. Curbs shall be cut at right angles, at the first scoring line beyond the intersection of the slopes alongside the driveway with the curb.

Rule 4—For residential driveways, the slope from the pavement shall extend to the front edge of the sidewalk but shall not be less than 3 ft. Residential driveways shall be constructed with the sides at right angles to the curb in all cases where the sidewalk is less than 3 ft. from the face of the curb and in such cases the slope or "X" distance shall be the same as for commercial driveways. The maximum length for residential driveways shall be 12 ft. for single and 20 ft. for double.

Rule 5—The length of driveway shall be interpreted as extending between the slopes or "X" distances, or to be W-2X.

Rule 6—No driveway approach shall be permitted within the curb return ahead of any traffic regulating device located on or adjacent to the curb return.

Rule 7—The total maximum length of commercial driveways shall be governed as follows:

A) When only one driveway approach serves a given frontage of property abutting on a highway where the speed limit is 25 miles per hour or less, the maximum length of driveway shall be 35 ft. Where the speed limit is 45 miles per hour, the maximum length of driveway may be increased to 40 ft., provided such increased length is not inconsistent with existing or future improvements. In no case shall the length of the driveway including the shoulders of "X" distances, exceed the property frontage.

B) When more than one driveway approach serves a given property frontage, the total length of driveways shall not exceed 70 percent of the frontage where such frontage is 100 ft. or less. Where the frontage is greater than 100 ft., the length of driveways shall not exceed 60 percent of said frontage. In either case, no single opening shall exceed 35 ft. in length if the property abuts a highway where the speed limit is 25 miles per hour or less, or 40 ft. where the limit is 45 miles per hour. A safety island with not less than 16 ft. of full height curb shall in all cases be provided between driveways serving any one property.

Rule 8—Where standard gutters and curbs are installed but adjacent improvements do not warrant concrete driveway construction, the driveways from the curb line to the premises may be constructed of the same materials as those used for paving the premises.

Rule 9—For locations where standard gutters and curb are not installed, the driveway lengths in Rule 7 shall be measured along the property line, and there shall be not less than 16 ft. of frontage between driveways serving any one property.

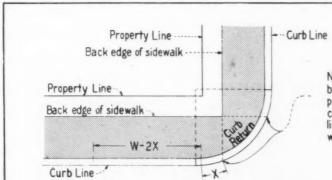
Rule 10—All paving or other improvements constructed within a highway right-of-way shall be maintained in a safe and usable condition by or at the expense of the permittee or property owner.

Rule 11—Frontage referred to in Rule 7\* includes approach areas directly in front of the property owned or under the control of the applicant, and such areas as may be opposite adjoining property which is used for approach purposes by right of easement with an adjoining property

Rule 12—Driveway approaches located within 5 ft. of the existing curb return at an alley intersection may be merged with the alley intersection pavement, requiring the removal of the curb return. The total distance of the driveway approach length, plus the alley width measured along the bottom of the driveway approach to the opposite alley line, shall not exceed 40 ft.

In Ohio driveway design and location are controlled by the Highway Director through his twelve Division Engineers. Anyone who wishes to build a driveway, or in any way use highway right-of-way, must apply for a permit to the Director, through the Division Engineer hav-

(Continued on page 159)



No portion of any driveway shall be permitted between the limits of the intersection of the prolonged back edges of the sidewalks and the curb. In the event a change is made in sidewalk lines subsequent to the construction of a driveway, the driveway shall be relocated.



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## APWA News

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### Local Chapters Report Well-Attended Meetings

Interesting and Informative Discussions are Featured with Topics Ranging from Administration and Inspection to Pipes and Tunnels

Over ninety members and guests attended the December meeting of the Southern California Chapter which featured the election of officers and three fine talks. The new slate of officers consists of J. F. Martinek, Director of Public Works, Riverside, President; B. R. Paris, Asst. Director, Bureau of Street Maintenance, Los Angeles, First Vice President; F. E. Randall of the Pacific Telephone and Telegraph Company, Second Vice President; and C. C. Westmoreland of the Southern California Gas Company, Secretary-Treasurer. J. M. Sever, Jr., editor of the "Southwest Builder and Contractor" told the facinating story of how the contractor overcame many serious problems encountered during the construction of the Tecolote Tunnel through the Santa Ynez Mountains in California. Raymond C. Baird, who is engaged in consulting engineering work in the Los Angeles area, described how the vibrating problem of a long pipeline suspension bridge bringing natural gas from Texas into California across the Colorado River was evaluated and solved, and John E. Baird of the Southern California Gas Company discussed the tickling topic of "Laughing Gas" at the annual banquet.

The Tennessee Chapter of the APWA and the Building Officials Association of that State recently sponsored a three-day training course, in cooperation with the Tennessee Municipal League and the University of Tennessee to meet the practical needs of officials whose duties involve the construction, operation and maintenance of municipal public works facilities. All sessions were held in the new University Center Building on the campus of the University of Ten-

nessee at Knoxville. Dr. C. E. Brehm, President of the University, opened the course with an address of welcome, W. E. Stone, Commissioner of Public Works of Lebanon, and President of the Chapter also took part in the opening ceremonies as did Robert Walker, Supervisor of Inspections of Nashville, and President of the Tennessee Building Officials Association. The excellent program included talks by Herbert Bingham, Executive Secretary of the Municipal League, S. Leary Jones, Director of the State Stream Pollution Control Board, R. V. Moschell, City Engineer of Alcoa, Angus R. Jessup, Consulting Engineer of Nashville, Professor A. T. Granger, Head of the University's Department of Civil Engineering and other members of the University faculty. The Public Works officials in attendance also enoyed a field trip through Knoxville's new sewage treatment plant.

The members of the New Orleans Chapter were fortunate in having the Honorable F. Edward Hebert discuss the status of the Tidewater Ship Channel legislation at their December meeting. The City of New Orleans is vitally interested in this project, as its realization will mean a tremendous gain in the industrial growth of city. Congressman Hebert pointed out that it takes a great deal of time to get a project of this magnitude underway, but informed the members and their guests that the House of Representatives had already passed a bill authorizing the construction of this channel which would be considered by the Senate during the present session of Congress. He also explained that another hurdle to be cleared after it becomes an authorized project is to

get adequate funds appropriated to finance the construction of the channel.

A breakfast meeting of the Utah Chapter was held in Salt Lake City last month in conjunction with the Thirty-Third Annual Convention of the Utah State Association of County Officials. E. Paul Gilgen, Weber County Surveyor, presided at the session which featured talks on highways and pre-stressed concrete by Ezra C. Knowlton, Executive Vice-President, and Allen Flandro, Chief Engineer of the Utah Sand and Gravel Company.

The last regular meeting of the San Diego — Imperial Counties Chapter was held on December 7th, 1955, at the Mission Valley Country Club, in San Diego. Eighty members and guests were present, including Frank A. Gibson, Chairman of the San Diego County Board of Supervisors. The luncheon meeting featured a lively panel discussion on the question: "Do we need uniformity in public works inspection?"

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The panel was moderated by Rolly N. Fowler of the San Diego Tractor Company, Warren A. Barney, Chief Engineer, of the San Diego County Public Works Department and Secretary-Treasurer of the Chapter, reports that there seemed to be unanimity of opinion among the contractors that inspection difficulties become more serious in direct relationship to the work load of the inspection staffs of the various agencies, and that inadequate inspection, creating serious difficulties, is the usual result when these staffs are spread too thin. The point was also made that inspectors' salaries are quite low which makes it difficult to recruit and retain competent and adequate inspection personnel. There seemed to be general agreement among those present, that inspection procedures and practices are very closely related to the specifications which the inspectors are required to interpret and enforce. Mr. Barney indicated that the next meeting of the Chapter would very likely deal with this particular aspect of the inspection

The effects of electrolysis and corrosion on underground utility

structures was the subject of discussion at a recent meeting of the Philadelphia Metropolitan Chapter. Mr. E. Carlson, Plant Engineer, of the Bell Telephone Company of Pennsylvania gave an informative talk on this topic and showed a film titled—"Corrosion In Action", which was enjoyed by a large turnout of members and guests at the Engineers Club of Philadelphia.

The annual meeting of the Wisconsin Chapter was recently held in Wausau, Wayne Volk, Traffic Engineer with the Wisconsin State Highway Commission presented an illustrated talk on highway signs and markings and urged uniformity in their use. Inspection trips were made to the Wausau Iron Works and the Wausau Concrete Company. Wayne Bryan, Director of Public Works of Neenah, heads the new slate of officers which was elected at this meeting. F. D. Kuckuck, Director of Public Service of Wauwatosa was named Vice-President; John F. Thompson, City Engineer of Madison was reelected Secretary-Treasurer and William Chadwick, City Engineer of Racine and Lawrence Manteufel, Supt. of The Wausau Sewage Treatment Plant were named Directors for two years. The Spring meeting of the Chapter is tentatively scheduled to be held in Sheboygan.

#### AMA Starts Highway Campaign In Detroit

The first of a series of regional highway rallies scheduled for each of the 48 states was held in Detroit, Michigan, December 21, 1955. Despite the holiday season and inclement weather, the luncheon meeting, sponsored by the American Municipal Association and other national organizations, drew a capacity attendance. The purpose of the meeting, and others to follow, is to develop strong "grass roots" support for the enactment of an expanded highway program during the 1956 session of Congress. More than 200 persons, representing state, county, and city governments, industry, retail business and labor joined with fourteen members of the states Congressional delegation in an informal discussion of the national highway needs and the importance of an expanded federal program to the plans and progress of the state, county and urban road systems.



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#### **Employer-Employee Relations:**

## "Fringe Benefit" Program for COUNTY EMPLOYEES

B. LOYAL SMITH,

Walla Walla County Engineer, Walla Walla, Washington

ROAD BUILDERS must depend upon people to get their mission accomplished. The finest machines available for building and maintaining our road system must still depend upon a human brain to accomplish the task which we as road building managers plan for the day's work. The human brain and personality are subjects of great concern. How can we get a man to feel as keenly about the job he is doing as we, who are responsible, feel about the mission and responsibilities assigned to us? Maybe we can get him to work harder for us if we treat him as a person and not as something in our list of equipment which we feel we can manipulate and reassign at will.

This person about whom we are talking has the same desires, the same wants and the same dreams that we, as engineers and managers, possess, and we must not overlook that important fact. Our workmen want enough money for an adequate. stable, well-planned life; they want a home and family; they want to be able to work safely so they can return to this family in one piece at the end of the day's work; they want good working conditions; in fact, they might want some of the other things that many of us now have and take for granted: the right to a vacation: the right to be paid when sick; the availability of an insurance program for health protection; the possibility of retirement income; the assurance of adequate safety devices at company expense; medical payments and hospitalization if injured on the job; overtime pay for excessively long days of work; transportation to jobs, when work is remotely located from the shop; payment for travel time when long periods are involved going to or from work locations. These and many others are the labor conditions that have come to be known as "Fringe Benefits".

In order to know how our 39 counties of Washington State compare on these matters, an Engineer's Association makes an annual survey of wages, salaries and working conditions and tabulates and publishes this information for the guidance of each individual County. We have been doing this for a number of years and now have very standardized "fringe benefits" in our 39 counties. The study has also greatly stabilized and standardized the salary and wage scales of the 39 Washington counties. Most of our labor force is quite stable the year round and made up of permanent employees whose sole business is that of building and maintaining our road system. Their "fringe benefits" are as follows:

Vacations: In 1954 36 counties granted 2-week paid vacations, while the remaining 3 counties granted 1 week of paid vacation to all men in the Department.

Sick Leave: Of our 39 counties, 31 now grant sick leave with pay; 28 of these 31 counties grant 1 day per month of paid sick leave, which in most counties may accumulate up to a maximum of 30 working days; the other three counties grant ½ day a month sick leave; eight counties in the 1954 survey had no such program.

Insurance Program: We have a State insurance program which covers doctor bills, hospitalization, and time lost pay when injured on the job. The cost of this Industrial Insurance program which covers hospitalization and lost time accident pay is borne entirely by the counties of our State. The premium for Medical Aid (or doctor bills) which varies from \$.004 to \$.035 per hour per man is shared equally by the County and the workmen. This has purposely been done by our State Legislature to impress upon the men that working safely pays. In addition to the compulsory insurance program just described, which is a mandatory requirement by State Law, most counties also have Group insurance plans, such as "Blue Cross" or similar organizations that may be voluntarily joined by the workman to give him the benefit of a cheaper group health protection for himself and his family by payroll deduction.

Retirement System: The 39 counties all belong to the "State Employee's Retirement System" which is contributed to by both employer and employee. The County or employer pays the equivalent of 5 percent of the workman's total salary or wage to the Retirement Board, and the workman contributes 5 percent of his salary or wage as a payroll deduction. The 5 percent contribution made by the workman purchases an annuity and draws annual dividends that accumulate to credit of the member's personal account.

Social Security: Because of our retirement program, action on expanded National Social Security is now under study by our State Association.

Travel Time, Travel Pay, and Overtime Pay: Most of our counties realize that much work is, of necessity, located away from shops or assembly points. Most counties expect their men to travel 15 to 20 minutes to get to work and a like period to return to their headquarters after the day is over. Travel time in excess of 20 minutes is normally considered regular duty and is paid for at the regular daily or hourly wage rate. All Washington counties furnish transportation from shop headquarters to the day's work for all workmen. In our State the 40-hour week is now standard. Work in excess of 40 hours is paid for in the manner established by the individual County by labor and payroll resolution or ordinances. Of the 39 counties, 13 pay time and one-half for overtime with the remaining 26 paying regular wage rates for overtime work. Organized labor unions exist in 14 of our 39

These are the items we call "Fringe Benefits". We believe that people who do not have to worry about the source of funds for illness, hospitals, vacation, old age, and retirement years are better workmen. We don't believe we can give everyone, everything he wants, but we believe we come close to meeting the basic needs of our workmen in Washington.

This is a portion of a paper presented by Mr. Smith at the National Highway Conference of County Engineers and officials, Gatlinburg, Tenn.

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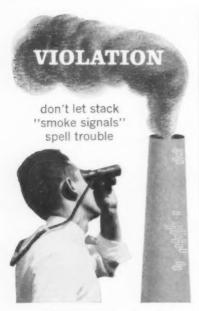
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# OF PUBLIC WORKS

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#### For Whom the Bridge Tolls

In Bettencourt v. State of California, 123 Cal. App. (2d) 60; 266 Pac. (2d) 201, decided Feb. 4, 1954, the issue was whether the state was immune from liability for its negligence in operating a toll bridge.

The State of California maintained a certain toll bridge and highway between the counties of Alameda and San Mateo, known as Dumbarton Bridge. It was alleged by the plaintiff that the State maintained the bridge in a defective and dangerous manner, that on a certain day when the lift span was raised no warnings were given or barriers raised, causing plaintiff's car to smash into the steel and concrete center roadway, injuring the plaintiff.

The defense was that the State is immune from tort liability, as it was engaged in a governmental operation at the time, rather than a proprietary activity. The issue thus raised was therefore whether or not the operation by a State of a toll bridge is a governmental operation or a proprietary (i.e. business) operation.

The argument that it is proprietary is based on the fact that tolls are charged, which seems to imply that this is a business activity. It is universally agreed that the management, control, construction, and maintenance of public highways is a governmental function rather than a business undertaking, and liability on the part of the State in such cases does not exist except where a statute so provides. But it was claimed in the present case that toll bridges are not open to the public.

The court held, in part: "The imposition of a charge for service is not inconsistent with the exercise of a governmental function. Neither is the profit or nonprofit phase of the



activity engaged in determinative of either a proprietary or a governmental function. The test is whether the particular activity in which the governmental agency is engaged at the time of the injury is of a public or of a private nature." The decision was that such a bridge was a part of the State's public highway system, and therefore a governmental operation. Therefore, the State was held to be immune from liability.

The case is commented on in 43 A.L.R. (2d) 550, where it is indicated that this decision is in line with the few other cases of a similar nature. However, in other cases in which a municipality was operating a bridge spanning a river between two states, it was held that this was a proprietary operation and not governmental, since the municipality has no governmental powers outside the State.

#### Responsibility for Snow Removal

The case of Smith v. District of Columbia, 189 Fed. (2d) 671 presents the problem of the liability of a municipality for injuries from snow and ice left on sidewalks.

Plaintiff slipped and fell at 14th and K streets, Northwest, in Washington, D. C., as she stepped from a crosswalk to a sidewalk on her way to work one morning. There had been a heavy snowfall ten days before the accident, and the intervening weather had been cold. The operator of the building at the corner had cleared the snow from about half the width of the sidewalk. There had been an additional snowfall the morning of the accident, the fresh snow being an inch or two deep. There were no structural defects in the street or pavement at the place of the accident.

Plaintiff sued the District of Columbia as a municipal corporation, invoking the "snow law". This law requires every person in control

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of a building fronting on a paved sidewalk to remove snow or sleet from the sidewalk within eight hours after it stops falling, and requires the Commissioners to do so if it has not been done and then to charge it to the proper person. The law also requires the Commissioners to remove snow and sleet from crosswalks, or to spread sand or ashes if this is not feasible.

The court held that, under the circumstances, clearing half the sidewalk was all that was required, and that there was therefore no negligence in this respect. The real problem thus was whether there was liability on the municipality for failure to clean the crosswalk.

It is well established in the District of Columbia that the municipality is liable for injuries resulting from negligent disregard of defects in streets. The snow law does not explicitly impose similar liability on the municipality in case of negligence in regard to its duty to remove snow, etc.

In 1884, the Supreme Court of the District of Columbia had decided that the municipality was not liable if it had no notice of dangerous conditions other than general knowledge of a severe and protracted storm. In the present case, the court altered the scope of this rule, holding as follows: "If the municipality has actual knowledge of the danger, or if the danger is so notorious or so long-continued that the municipal authorities are charged with constructive notice of it, the municipality is liable for injuries resulting from it." The court therefore reversed the trial court's directed verdict for the defendant, stating that the issue was one of fact which should have gone to the jury. For example, if snow or ice had been permitted to form humps or ridges so as to aggravate the ordinary danger of slipperiness, and this had continued for some time, the municipality would be liable; otherwise, it would not.

The entire question of municipal liability in such cases is reviewed in considerable detail in 39 A.L.R. (2d) 782. As pointed out in the principal case, as well as in the A.L.R. annotation, liability in such cases is always predicated on negligence. It is not enough that someone falls and is injured, unless negligence on the part of the municipality can be shown. The case cited is in accord with the weight of authority as to this point, and as to the distinction between natural slipperiness and the slipperiness of rough ice.



The modern combination of Dorrco Bar Screen-Dorrco Sulzer Disintegrator is paying real dividends at Los Angeles' mammoth Hyperion Treatment Plant. The initial Disintegrator was installed late in 1953 to operate in "closed-circuit" with four Type S Bar Screens. For approximately eighteen months this one unit ground all screenings from an average flow of 249 MGD! A second unit has since been installed to serve as standby.

Essentially a low-lift, axial flow pump, the Disintegrator produces a mealy product which is returned to the plant flow without affecting subsequent treatment steps. A separate pump draws sewage from behind the bar screens and flushes screenings through a covered trough into the grinder. Wear results have been good in view of the considerable amount of grit contained in the screenings; periodic inspection and blade replacement have held maintenance costs to a minimum.

ment have held maintenance costs to a minimum. If you'd like more information on this modern answer to the screenings handling problem, write for a copy of Bulletin No. 6400. Dorr-Oliver Incorporated, Stamford, Connecticut.

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#### **PUBLIC WORKS DIGESTS**

### The WATER WORKS



### Digest

#### Membrane Filters For Quality Control

The advantages of the membrane filter for the control of potable water supplies and stream sanitation studies far outweigh the disadvantages, since precision of measurement is of paramount importance in those fields. The fermentation tube technique will continue to be used by many analysts. Many probably will run parallel tests for a while to observe correlation of results. For the first time in history sanitary science has a simple, accurate and precise method of potable water analysis.

"A Realistic Appraisal of Membrane Filters for Water Quality Control." By Rolf Eliassen, Prof. of San. Eng., M.I.T. Water & Sewage Works, December.

#### Cleveland's New Intake

Cleveland, Ohio, is constructing another intake in Lake Erie to bring water to a 50 mgd filter plant. It will consist of 13,000 ft. of reinforced concrete pipe 96-in. inside diameter, at the end of which is a 90° elbow. The elbow is surrounded by a crib 60 ft. in diameter and 10 ft. high. A 13-ft. wide belt of horizontal wood screening panels around the perimeter of the roof of the crib is the only part of the structure open to water. The elbow was constructed on shore

of reinforced concrete, floated to place and sunk in a trench 16 ft. deep, resting on and surrounded by crushed stone. The crib, which rests on this broken stone, is of steel covered with concrete sprayed onto wire mesh reinforcing, the outside walls being further protected with bituminous enamel. The crib contained eight watertight cells around the perimeter, which permitted it to be floated into place, when the tops of the cells were cut open and they were filled with concrete. The wood screens are made of 3 x 12 in. planks set on end 3% in. O.C.

"Cleveland Taps Lake Erie Again." Engineering News-Record, December 1.

#### Pipe Slime Caused by Coagulated Water

A gelatinous or slime coating formed over the inside surfaces of the tunnels and water pipes of Chicago's South Water District in a period from August, 1945 to May, 1947, when the water was being coagulated and settled but not filtered. This reduced the carrying capacity by 10 to 30%. Various ideas as to what might be the cause were investigated. It was not corrosion, since the deposit formed on masonry as well as iron. Analysis of the coating shows that it is composed mainly of silicon dioxide and aluminum hydroxide. No reduction in

carrying capacity has occurred since the filters were placed in service in 1947. The lesson learned is not to turn coagulated water into a distribution system, even though the period of settling after coagulation may be long.

"Gelatinous Coating Produces Friction Loss in Piping System." By John R. Baylis, Eng'r of Water Purification. Pure Water, November.

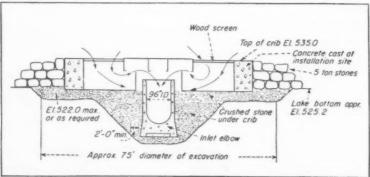
#### Power From Atomic Energy

An official of the General Electric Co. estimates that by 1975 nearly one-half of the power stations then under construction will use nuclear fuels. However, the demands for power then will be three or four times as great as now, and it will be necessary to increase the conventionally fueled generating capacity to three times that in service at present. The cost of a nuclear plant will be substantially greater than that of a coal-fired—one probably by 50%; but the cost of fuel per kwh will be considerably less. By that time the supplies of fossil fuels will be sorely strained. Enormous quantities of filtered water are necessary for reactor cooling.

"Atomic Energy and the American Economy." By Nelson P. Jackson, Atomic Products Div., G. E. Co. Jour. AWW Ass'n, December.

#### Charges for Private Fire Protection

Many engineers, water works operators and managers hold to the opinion that a charge should be made for a sprinkler service: others are of a contrary opinion. The author advocates such charge, saying that "Any utility which does not make a proper charge for private fire protection service is obviously loading the expense of that service on the other classes of users, on the general tax paper." One who has a private fire connection uses little or no water and so, in a fully metered town, pays nothing toward the support of the system if there is no



Courtesy Engineering News-Record

• INTAKE CRIB for the Cleveland water supply. Solid arrows show lines of flow.

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stand-by charge for his private fire connection. Other opinions, pro and con, are stated in discussions by Louis E. Ayres and Richard H. Ellis.

"Ready-to-Serve Charges for Private Fire Protection." By Leonard R. Hanson, Dept. of Water and Power, Los Angeles, Calif. Jour. AWW Ass'n, December.

#### Solution of Cement in Pipes

Nearly 70% of the cast iron pipe now in use is cement lined; some lines are constructed of asbestoscement pipe; and many miles of concrete pressure pipe are in service. An investigation conducted by the American Water Works Service Co. and the Lock Joint Pipe Co. has shown that concrete pressure pipe is only slightly affected by even aggressive water over service periods of 25 years and longer; no case of failure or even serious damage to concrete pipe was found attributable to the solution effect of water on the concrete. When new concrete pipe is put into use, a reaction takes place which soon stops further solution of calcium and leaves the concrete in good condition below a 1/32 to 3/32 in, thick surface layer. This reaction

is not clearly understood. Further study is needed to determine why concrete resists solution in water works service, and the effectiveness of paint seal coats. As to the last, P. S. Wilson states that a 6-yr test of the seal coat furnished by the Gregg Co. showed that pipe so coated had been unaffected, while uncoated pipe showed substantial leaching, which was still continuing at diminishing rates. Thomas R. Camp found that, in the case of one line of 30-in, reinforced concrete pipe, two years after going into service, the pH of water flowing through it increased at a rate which was calculated to indicate a loss of about 0.006 in. per year. But as only the lime leaches out and lime occupies only 20% of the volume, the leaching was penetrating the concrete at the rate of 0.03 in. per year.

"Solution Effects of Water on Cement and Concrete in Pipe." By Martin E. Flentje and R. J. Sweitzer. Jour. AWW Ass'n, December.

### Pipes Broken By Earth Movement

Winnipeg for years has been plagued with broken water mains. most of them transverse breaks, indicating that they were caused by outside stresses and not by internal pressure. An investigation indicated that while some of the breaks were due to the practice of laying the pipes on blocks, a large percentage were due to the shrinkage and swelling of the soil as it absorbed moisture and dried out, the soils there consisting of highly plastic and stratified lacustrine clays. Building foundations had been known to rise 4 in. during a flood and settle again. Pressure in the soil due to absorption had been measured up to 20 tons per sq. ft, and one ton is not uncommon. Added to the soil pressure, the soil is especially corrosive to iron pipes, and undoubtedly weakens them.

"Effects of Physical Environment on Cast-Iron Pipe." By Andrew Baracos, Prof. of Civ. Eng., Univ. of Manitoba; W. D. Hurst, Greater Winnipeg Water Dist; and R F. Legget, Nat'l Research Council of Canada. Jour. AWW Ass'n, December.

#### Reuse of Sewage Effluents

Investigation of problems involved in the purification of sewage for reuse was given priority, states the annual report of the South African Council for Scientific and Industrial Research. Thus the pilot plant units at the Pretoria and at the Cydna



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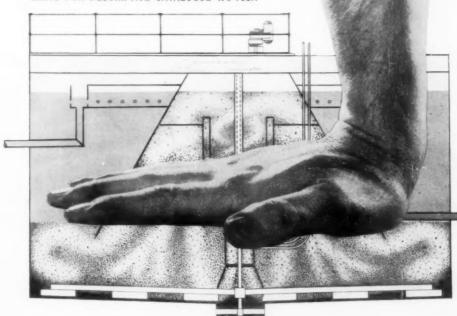
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(Johannesburg) sewage works have been completed and brought into operation. The results indicate that vleis and grasslands provide effective screening of suspended material from the water, but removal of nitrogenous compounds and production of dissolved oxygen were impaired when excessive growth of macroflora prevented access of sunlight to the water. Prolific growth of algae developed rapidly in sewage effluent exposed to sunlight, and it became apparent that this algae plays an important part in the purification process. Following this observation,

shallow concrete pools were constructed, specifically for studying the purification afforded by algae. From these experiments it has been concluded that a combination of vleis, algal beds, grass beds and impounding reservoirs would be most effective in rendering sewage effluents fit for unrestricted re-use. Any one of these units on its own afforded incomplete purification. Parallel to these experiments, chemical treatment methods were also investigated. The final sterilization of sewage effluents offers a serious restriction to their more extended re-use,

since the high level of chlorine dosage required entails high costs.

"Reuse of Water." Water (England), November.

#### Pulverized Quicklime For Water Softening

North Miami, Florida, operates a water softening plant with a capacity of 7.75 mgd. Until recently hydrated lime had been used for this purpose. Quicklime has several advantages over hydrated, the chief objection being the cost of installing and operating slaking equipment. Experiments at this plant demonstrated that pulverized quicklime could be used without slaking. The use of this material requires less chemical storage space than does hydrated lime and causes less dust in handling; it permits more accurate proportioning than do other forms of quicklime and eliminates occupational hazards connected with slaking. Pulverized quicklime costs more per pound than hydrated lime. but costs less per mg of water treated.

"Use of Pulverized Quicklime for Water Softening." By D. W. Jones, Supt. Water & Sewage Works, December.

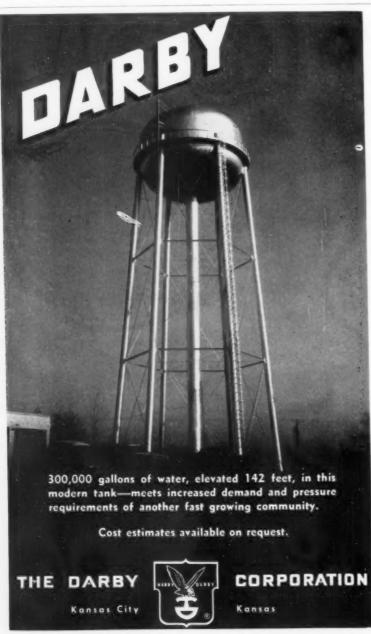
#### Fluoridation In Grand Rapids

Grand Rapids, Michigan, completed ten years of continuous fluoridation of its water supply on January 25, 1955. During this period no opposition by consumers developed. At the beginning, Muskegon, which used the same source of supply and did not use fluoridation, had been taken as a control for comparing results obtained in reducing teeth decay, missing and filled teeth in children; but six years later this city also adopted fluoridation and so was lost as a control. However, on April 6, 1955, the Kent County Dental Society stated that "10 years of fluoridation in Grand Rapids has added to the indisputable evidence on the safety and the value of supplementing water supplies with fluorine" and it recommends fluoridation of water for all communities needing it, as a sound and profitable advance in safeguarding health."

"Fluoridation's Decade of Dental Gains in Grand Rapids." By W. Leslie Harris, Water Plant Supervisor. American City, December.

### Sea Water for Fire Protection

Use of sea water instead of potable water for fire protection is common for military and industrial installa-



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tions where it is accessible and fresh water is scarce. The chief problems connected with its use are fouling by marine organisms and corrosion. The sprinkler heads, valves, pipes, etc. used in automatic sprinkler systems are continuously in contact with the water always standing in them ready for instant service, but to make these of materials not affected by sea water would be prohibitively expensive, and the author describes a system in which sea water contacts these metallic parts only when the sprinklers are in operation. After each use of the sprinklers, the system is flushed with fresh water and left standing full of such water. Then, when the sprinklers operate again, this fresh water escapes, and in so doing opens valves which admit salt water. For controlling marine growths he suggests the use of chlorine.

"The Design of Sea Water Fire Protection Systems." By Robert E. Proctor. Public Works, January.

#### Other Articles

"Fena River (Gaum) Water System," filtration plant and storage and balancing reservoirs. Public Works, January.

"Pipe Pusher Installs Water Supply Tubing and Pleases Home Owners." Public Works, January.

"Studies in Water Reclamation." Report by Sanitary Engineering Research Laboratory of the Univ. of California. Public Works, January.

"Corrosion and Materials in the Water Works Field." By R. W. Henke, Badger Meter Mfg. Co. Water & Sewage Works. December.

"Lubricated Plug Valves Gain Wider Use in Water Works." By T. H. M. Taylor, Nordstrom Valve Div. Water &

Sewage Works, December.

"Water Works Liability for Furnishing Water Dangerous to Health" By John H. Murdoch, Jr, Ch'f Counsel, Am WW Service Co. Water & Sewage

Works, December.

"Design Criteria for Distribution Systems." By H. E. Butler, Sr. Water Eng'r, Glendale, Calif. Jour AWW Ass'n, December.

"Bibliography of Safety Information Sources." Jour, AWW Ass'n, December.

#### Storm Sewer Design

(Continued from page 95)

The load factors on pipe with various class of bedding as worked out at Iowa State have been given. Recommendations for maximum depth of trenches for plain and reinforced concrete pipe of various sizes with four types of bedding and assuming soils weighing 100-lb. and 130-lb. per cu. ft., were published by the American Concrete Pipe Associa-

tion in its "Concrete Pipe Hand-book" first issued in 1951.

It is known that when a pipe is placed in a trench and covered with earth, the backfill has a tendency to settle downward. This tendency toward downward movement of the backfill above the pipe is retarded by frictional forces along the sides of the trench when the trench width is kept to a minimum. These frictional forces act upward on the backfill in the trench and help support the backfill.

#### Marston's Formula

According to a formula evolved by W. J. M. Rankine, the vertical frictional forces are equal to the active lateral pressure by the earth backfill against the sides of the trench multiplied by the tangent of the angle of friction between the two materials. Based on this reasoning, Dean Marston's formula for determining the load on an underground conduit is as follows:

 $\begin{aligned} W_d &= C_d \ w \ B_d{}^2 \\ \text{in which } W_4 &= \text{fill load in lb. per} \\ \text{lin. ft. of conduit; } C_d &= \text{load-calculation coefficient; } w &= \text{unit wt. of fill material in lbs. per cu. ft.; and } \\ B_d &= \text{width of trench at or slightly} \\ \text{below the level of the top of the conduit, in ft.} \end{aligned}$ 

The values of Cd, for a number of soils, have been plotted against values of the ratio H/Bd, as shown in Fig. 4. The values of Ku and w for each case should be those which result in the maximum calculated load which is probable in the particular case. In some instances it may be advisable to determine the actual values of w and Ku. When the character of the soil is unknown or uncertain, it is common practice to assume w = 120 and  $K_{\mu} = 0.130$ : these values give the maximum loads which are probable with any of the commonly encountered soils. A study of the load formula and the Cd diagram will show the marked effect which the width factor Ba has upon the load. An increase in the width of the trench will cause a reduction in H/B<sub>d</sub>, and also a small reduction in Cd, but since the load varies with Bd2 an increase in Bd will cause a marked increase in load. Consequently the value of Bd should be held to the minimum which is consistent with efficient construction operations. Note also that the width of the trench is taken as the horizontal width at the top of the conduit. If the trench has sloping sides, the load on the pipe is equal to that for a vertical sided trench with a width equal to the width at the level of or slightly below the top of the pipe.

Pipe trenches in all instances should be wide enough at the bottom to give workmen room properly to bed the pipe to established line and grade and also to permit filling and inspection of joints where required. For pipe 4, 6 and 8-in. in diameter the trench should be not less than 18-in. wide. Trench widths for pipe lines from 10 to 108-in. in diameter should be from 12 to 26 ins. greater than the external diameter of the pipe. Trench widths are frequently specified to be four-thirds of the internal diameter (ID) of the pipe in inches plus 8 ins. (4/3 ID + 8").

#### Construction of Joints

Storm sewer pipe sections should be joined with care to provide a smooth flow line and to prevent excessive infiltration of soil particles. Minimum allowable infiltration of water is not as important in storm sewers as it is in sanitary or combined sewers. In fact, airport drains and some other systems are designed with perforated pipe to permit the entrance of water through holes in the walls of the pipe itself. A gravel pack is placed around these lines, however, to prevent the entrance of fine soils which might undermine the pipe sections and cause misalignment or more serious consequences.

Sides of trenches of any depth in wet, unstable soil should be braced with timber during construction. Deep trenches should be timbered to protect workmen from cave-ins. Timbering or other protection is mandatory in most states. Several types of trench boxes of metal have been developed and are available for use instead of timbering.

This discussion of storm sewers has been confined to planning, design and construction procedure most commonly followed in medium-sized cities and towns in the United States. The formulas and practices described have assumed the use of precast concrete pipe, the type most commonly specified. No consideration has been given to cast-in-place sewer lines which present quite different problems and would require many pages to give even a smattering of present practice in this growing field.

We have also confined the discussion to storm sewers for municipalities and omitted reference to the vast amount of such construction which has been done for civilian and military airports, on which quite similar procedure is followed.

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THE rapid and continuing population expansion of Phoenix, Arizona—63% from 1940 to 1950—called for a recent 30-mgd addition to existing filtration facilities. Using Link-Belt chemical and floculation equipment, this water treatment system can handle 40-mgd in an emergency. From a master plan projected to the year 2000, further extensions can be made with minimum changeover.

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#### **PUBLIC WORKS DIGESTS**

## The SEWERAGE AND REFUSE Digest

## TEST AND UNITY AND STREET

#### Lagoons in the Midwest States

The author obtained data from departments of health of 19 midwest states. Four of them reported that many of their cities are handling raw sewage in lagoons and obtain BOD reductions of more than 90 percent, a high degree of oxygen supersaturation, and a complete absence of odor. The lagoon at Kearney, Nebraska, occupies about 10 acres of sandy soil and receives the sewage from about 12,000 people with an average BOD of 160 ppm. or more than 180 lb. per acre per day, and in summer reduced it more than 95 percent, and in winter more than 85 percent. Several authorities report concentrations of coliform bacteria in the effluents considerable less than are found in effluents from other types of plants. All lagoons seem able to handle temporary overloads of several hundred percent. The present generally accepted area for treating raw sewage is one acre for each 100 persons, but there are indications that this is unnecessarily great and that one acre for 200 persons is practicable. However, even this area is much greater than is needed for other types of plants. Lagoons therefore are not practicable for large cities; but for small cities they may permit considerable saving in cost of both construction and operation.

"Municipal Sewage Lagoons in the Midwest." By Donald E. French. Water & Sewage Works, December.

#### Laying a Compound Sewer in Tunnel

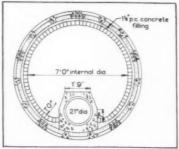
In carrying out a drainage and sewerage scheme, Stoke on Trent, England found it necessary to construct 1560 ft. of storm sewer in tunnel, and a sanitary sewer along the same route. The plan adopted was to put the sanitary sewer in the invert of the storm sewer. The storm sewer is 7 ft. inside diameter; the sanitary sewer is 21 in., encased in concrete which extends about 18 in. above the invert of the storm

sewer; and divides the normal flow therein into two streams, one of which can be closed off if desirable for making repairs. The sanitary sewer also can serve as a cat walk for making inspection. The storm sewer was circular, built with reinforced concrete segments as tunnel lining, five segments to a ring, and lined with hard-burned bricks.

"New Estate is Drained by 1,560-Foot Culvert." By A. V. Boardman, Municipal Engineering (England), Nov. 18.

#### Sludge Disposal In Allegheny County

The \$20,000,000 plant to be constructed for treating the sewage and wastes from 66 communities in Allegheny County, Pa. has as its most important feature a novel method of disposing of the sludge. Raw sludge will be concentrated for five days and then incinerated. Laboratory and pilot plant experiments over a period of three years have demonstrated that raw sludge, preheated to 95 deg. F and stored for a period of three to five days, will produce a concentration averaging 18 per cent total solids by flotation. This method requires supplemental fuel for combustion. Fine coal, known to the trade as slack, and the cheapest to produce, will be mixed with the concentrated sludge immediately prior to incineration, or the two may be applied to the furnaces separately, depending upon the type of incinerator selected.



Courtesy Municipal Engineering

• SECTION of the sewer and tunnel.

The design provides for a battery of ten concentration tanks, one-half of one tank to be used as a raw-sludge compensating tank to serve the pre-heaters. The tanks will have a total capacity of 3,250,000 gal. and are designed with saw-toothed bottoms in section, with longitudinal screw conveyors for homogenizing and removing the concentrated sludge. Warm air will be circulated above the sludge in the tanks and returned to the incinerators as combustion air, thus eliminating odors. The tanks are to be insulated.

Tests have shown that the heated sludge will rise to the top with subnatant forming on the bottom within 24 hours after heating. The subnatant can then be withdrawn at the most propitious time, permitting the concentrated sludge to drop to the bottom of the tank. Subnatant will be returned to the effluent channels of the grit chambers.

\$100 Million Loan Finances the Allegheny County Sewage Works." By John F. Laboon, Chf. Engr. Wastes Engineering, December.

#### Oxidation Pond Receives Septic Tank Effluent

West Virginia in 1953 nearly doubled the capacity of its Denmar Sanitarium, but made no provision for increasing the sewage treatment plant, which consisted of a septic tank and subsurface filter trench. Instead of increasing the subsurface disposal area, the Board of Control, at the author's suggestion, constructed an oxidation pond having an area of 1.73 acres and depth of 3 ft. This was placed in service in May, 1954. Part of the time, the evaporation and seepage have equaled the inflow. The estimated flow of 30,000 gpd, of raw sewage and tank effluent had a BOD of 172 ppm and 112 ppm respectively, while the BOD of the pond was 8 ppm; the coliform MPN was 1,100,000 in the septic tank effluent and less than 300 in the pond. The septic tank removed about 35% of the applied BOD and the pond an additional



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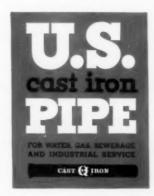
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60 percent. The reduction of coliform organisms was over 99.97 percent.

"Treatment of Septic Tank Effluent by an Oxidation Pond." By H. K. Gidley, Director, Div. of San. Eng., of W. Va. Public Works, January.

### Incinerating Municipal Refuse

The author outlines a plan for incinerating municipal refuse and converting the heat to electric power for sale to a local utility. To insure receipt of material for continuous operation, commercial refuse can be burned. Either a steam or an air

cycle turbo-generator can be used to develop electric power. He favors gas turbines operated on low-pressure air, although these cost about 33 percent more. He estimates that such a plant can easily be amortized in ten years.

"Economies in Collection and Disposal of Municipal Refuse." By Frank J. McDevitt, Pres. Bd. of Pub. Service, St. Louis. Public Works, January.

#### Test of a Digester Additive

The sludge digesters of the New Milford, N. J. sewage treatment plant, built in 1937, became so overloaded that the two unheated digesters provided only 20 days detention. In 1954 and 1955 test was made of a digestion aid which was added to tank No. 1, while No. 2 was operated without an additive as a control. During four months no sludge was withdrawn from No. 1 and 7,760 cu. ft. during the fifth month. During the same five months, 5,000 to 3,000 cu. ft. per month were withdrawn from the untreated tank, a total of 19,640. Following this, both digesters were treated with additive for 51/2 months and the results compared with those of the previous year. The total amount of sludge withdrawn was 10,000 cu. ft. as compared with 65,000 cu. ft. during the same period of the previous year.

"Field Test Indicates Effectiveness of Digester Additive." PUBLIC WORKS, January.

#### Conservation Potential Of Sewage Sludge

The authors have compiled data relative to the constituents of various sludges, the amounts produced per capita by various cities, the nutrient balance on American farm lands, and other related considerations, and conclude that, if the 1,000,000 tons of dry sludge expected annually from all United States sewage treatment plants were spread uniformly over the entire American crop land it would amount to an addition of approximately 5.5 lb. of sludge per acre; of the chemical nutrient deficiencies estimated for 1949, it would add about 1/250 of the nitrogen, 1/9 of the phosphates, and 1/9,000 of the potash. The application of all sewage sludge produced in the United States in 1949 or 1950 probably could have increased agricultural production something less than 0.5 percent. However, no single method of increasing our agricultural potential should be overlooked, and sludge should be used as fertilizer where it would be economical and safe to do so under local conditions.

"Conservation Potential of Sewage Sludge." By James F. Thomson and James M. Morgan, Jr. Water & Sewage Works, December.

#### Surface Aeration Activated Sludge Plant

At the Davyhulme sewage treatment plant of the Manchester (England) Rivers Dept., several activated sludge systems are in use. One is the "Simplex" surface aeration. In May, 1954, "high intensity cones" were installed to improve the opera-



The New Joint Benton Harbor-St. Joseph, Mich. Sewage Treatment Plant designed to serve an equivalent population of 75,000 is in full operation.

A novel feature is that it is of the split activated treatment type with provision for 8 MGD primary and 4 MGD secondary flow. The sewage pumps are driven by two 100 H.P., 720 RPM, 8 cylinder, Climax sewage gas engines having automatic speed control which can vary the pumping capacity from  $1\frac{1}{2}$  to 12 MGD.

Two 4100 CFM blowers are driven by 160 H.P., 720 RPM, 12 cylinder, Climax sewage gas engines equipped with governors having manual control for speed variation.

Climax engines were selected because of their known economy, dependability and flexibility.

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tion of these, and the report of the Department for the year ending March 31, 1955 says that since then the installation has run without a stoppage and the effluent has complied with the Royal Commission standards. The horsepower required was 28.8 per m.g., considerably less than was required by either the difused air or bioaeration units; it is able to treat about 70 percent more sewage and produce a more satisfactory effluent with less horsepower per mg. Little foam has been produced on these tanks, although it was a nuisance on the diffused air aeration tanks.

"Performance of Manchester's Activated Sludge Plant. The Surveyor, Dec. 3.

#### Other Articles

Refuse Incinerator. "It's OK in Los Angeles," where air pollution requirements are extremely strict. By C. B. Afflerbaugh, Mgr. Los Angeles Co. Fair Ass'n. American City, December.

"How to Solve Sewage Problems of Fringe and Inter-City Areas." Abstracts of papers before the Conference of the FSIWA. Wastes Engineering, December.

"Grit Removal Equipment." By Le Roy W. Van Kleeck. Wastes Engineering, December.

"Men and Mechanism Make the **Tole-do Sewage** Plant Klick." By A. H. Niles, Eng-Supt of Sewage Disposal. Wastes Engineering, December.

Research in Sewage and Industrial Waste Treatment. A review of college research programs. Public Works, January.

"Sewage Treatment Developments at Minneapolis-St. Paul." Filtering through Saran Cloth, and use of carbide lime slurry, in 1954. Public Works, January.

"Reports on the Gas-Liquor Problem and Dosing of Percolating Filters" in England. By John Finch, Mgr of Sew. Disposal, Slough, England. Water & Sewage Works, December.

"Sewage Works Practices: Grit Chambers." By Don E. Bloodgood, Prof. of San. Eng, Purdue Univ. Water & Sewage Works, December.

#### Remote Control

(Continued from page 111)

together and remain in synchronization. Furthermore, to prevent false operation, one contact on each scanning mechanism is used for synchronization. Once every revolution the receiver and dispatcher switch pause on the zero number contact, for approximately three seconds, in order to be synchronized accurately. In the event the two units are not in synchronization one unit will stop and wait for the other unit to



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## "POW-R-DITCHER IS SUPERIOR FOR SMALL MAINS & SERVICES"

Says "Bud" Somerville and Supt. Jim Godwin of the SOMERVILLE CONSTRUCTION CO., Ada, Michigan

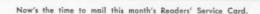
"We have used several makes of ditchers and find the Vermeer 4T POW-R-DITCHER superior for installation of small gas mains and services. We get more footage with less destruction to landscaping. Our experience in this type of work covers a 15 year period and a great variety of ground conditions."



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Some Excellent Sales Territory Available VERMEER MFG. CO., Pella, Iowa



get back in step, after which both units continue their operation in proper synchronization. Loss of power at transmitter, line "open" or line "short" leaves controlled units in their status quo condition.

Where telemetering functions are wanted, the telemeter transmitter and receiver are connected to corresponding segments of the substation and central station scanning commutators. When these commutator segments are connected to the line, a circuit is established so that the telemetering equipment functions in its normal manner just as

though it were connected to the line continuously. The scanning mechanism at each station is stopped for a brief period so that at least two time-impulse telemeter signals are received, thus insuring that the receiving element faithfully registers the last assumed position or magnitude of the measured variable. After this brief delay the scanning mechanism resumes its progress and additional telemetering functions, if included, are successfully transmitted in the same manner along with the associated control functions. The telemeter receiving mechanism maintains its last assumed position until it is again connected through the action of the scanning mechanism; thus a continuous record is provided of the telemetered function.

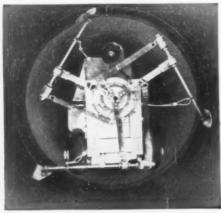
#### Line Charges

The sequential type of tranmission just discussed was originally described by Jester and Henderson(7) and was devised to reduce transmission line charges. Rental charges for telemetering and control transmission circuits are usually based on the type of line, quality of circuit and the number of signals that are being transmitted simultaneously on the line. Quite frequently rental charges are based on the number of simultaneous transmissions which may occur, even though only a single pair of line wires are utilized for this purpose. With the sequential type transmission only one function is being transmitted at a given time and, therefore, the line rental charges are based on a single transmission circuit, resulting in considerable savings. Where voice transmission is not involved, low grade telemetering channels are available from most of the telephone companies, permitting additional savings. Many companies compute their line rental charges on the basis of air miles rather than wire miles, which aids in keeping rental charges

On occasion there will be variables for which it is desired to have continuously telemetered information available. In such instances, audio frequency tones may be imposed on the control circuit so that a particular telemetering function may be transmitted continuously over the same lines along with other telemetering and control functions.

A simple installation for the control of two remote pumps, two valves and indication of two reservoir levels is used by the City of Bessemer, Ala. This system operates over 12 miles of leased telephone lines and has been in operation for some time.

A more complicated telemetering and control system was installed at Jacksonville, Ill., to telemeter the sum of four flows and control the operation of four pumps. In this instance the pumping station delivers raw water to the filtration plant approximately 29 miles away. Suitable connecting lines were not available and a radio carrier link is employed between the two telephone exchanges. Four tone channels are utilized to key the carrier transmitter.





## CENTRILINE goes to CUBA

The Centriline process has been selected by Municipio de la Habana to play an integral part in the expansion of this city's water supply system. Over 114,000 feet of new welded steel pipe, ranging in diameters from 30" to 78", will be cement-mortar lined in the near future.

In this process, the novel machine illustrated above is drawn through the pipe while cement-mortar is centrifugally sprayed on the pipe walls and troweled smooth by the rotating arms. Mortar thickness is controlled by the speed of the entire machine. Because the pipes remain in place throughout the process, traffic interruption is cut to a minimum; time and money are saved.

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Supervising engineer on the project is Francisco Pividal, C. E.; Chief Engineer is Adrian Macia, C. E.; General Contractor: Comp. Constructora M. A. Gonzales del Valle, S. A.; Pipe Contractor & Manufacturer: Tuberia de Concreto Universal, S. A.

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Arrange to see the SeweRodeR in operation — not on a routine job, but on a tough assignment — and you will agree with Johnstown, Pa. that investment in a SeweRodeR is one way to get the most for the Taxpayers' Dollar.

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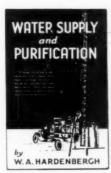
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illustrate practical, up-to-date methods. Among the major changes introduced in this latest edition are the following: the chapters on ground water, on filtration, and on laying pipe and maintaining lines have been almost completely rewritten; the chapters on pipe conduits and on disinfection have been revisd to bring the material in them up to date; and a new chapter has been added on fluoridation.

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Manufacturing Co., Newnan, Ga.

A more elaborate dispatcher's panel is in use by the City of Whittier, Calif., to control the operation of 15 pumps, report back high and low suction well levels and indicate and record nine telemeter functions. Scanning units have been wired to provide up to 13 future control functions for pumps, valves, etc. as need develops. An auxiliary display panel is installed in the superintendent's office.

#### Costs vs Value

The question is frequently raised as to whether the first cost and maintenance cost of elaborate, complicated control systems can be justified. Collie, (8) in describing a telemeter monitoring system for the City of Houston, Texas, concluded that such a system is justified because of the more reliable and improved service resulting from its

Raasch<sup>(0)</sup> has described a rather elaborate control and monitoring system for a group of widely scattered pumps, valves, tanks and reservoirs for Dallas, Tex. In this instance the telemetering and control system will repay its original cost in

approximately four years and thereafter show a profit of approximately \$16,000 per year. This profit is a saving in expense because fewer man hours are necessary for the proper operation and control of the system and there are considerable savings in truck equipment, maintenance and mileage. In addition to the actual cash savings made, the entire system may be operated with greater dispatch resulting in improved customer relations and the supervisory crew formerly used to start and stop pumps manually, supervise reservoir levels, pressure, etc., is now available for maintenance. Maintenance may now be more promptly performed and the equipment inspected, adjusted and serviced before there is any actual breakdown

In addition to pump and valve control and telemetering of the usual quantities such as pressure, temperature level, flow, etc., by this Supervisory Control System, it is practical to monitor such functions as turbidity, chlorine residual, pH, conductivity, etc. With this information available, it is quite practical to position remote gates to provide the proper blend of raw or treated water, to cut out reservoirs which are affected by storms, or to adjust the setting on remotely located chlorine or chemical feed machines.

With higher labor costs and shortages of skilled labor, telemetering and control systems are becoming a necessity and a tool by which the problems of remote operation may be simply and readily solved. As has been pointed out, not only are monetary savings available through the use of such equipment but improved operation and better customer relations are automatically provided.

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M&H PRODUCTS INDUSTRY . SEWAGE DISPOSAL AND FIRE PROTECTION

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3. Collie, R. M.—"Central Dispatching", Journal AWWA, May 1955, pp. 426-432.

9. Raasch, Dallas, "Telemetering and Control System for the LaMesa, Lemon Grove & Spring Valley Irrigation District". Presented at Southern California Section AWWA— April, 1955.

### Preassembly Speeds Laying Vitrified Clay Pipe

In constructing the sewer system for Carol City, Fla., pipe laying was speeded up by preassembling the vitrified clay pipe into seven-section lengths and then hauling these to the job site and lowering into the trench. Steps in construction were:

1. A three-foot length of pipe with pre-cast spigot is placed on the ground vertically. Another length of pipe with pre-cast bell was then set on top and the joint hot-poured with asphalt or bituminous compound.

2. Three of these two-length sections were placed on templates and the pre-cast joints "shoved home," forming an 18-foot section.

3. A regular pre-cast length of pipe was then added to complete the 21-foot section.

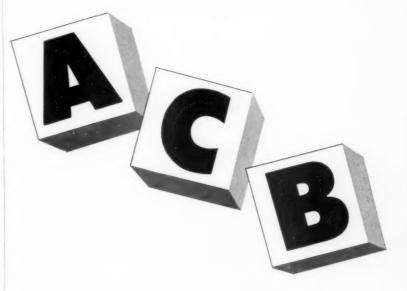
This plan permitted two men to preassemble 2,000 feet of pipe into seven-length sections per eight-hour day. Completed sections were moved to supporting racks on wagons. Each wagon hauled 210 feet of preassembled pipe and trains of three wagons delivered the pipe to installation site. Pipe loss was insignificant, less than a single length in 2.500 feet.

Connections were made in the trench easily, since precast joints were used for the ends of the assemblies and pushing together of the preassembled sections was all that was needed.

### Street Sanitation in Milwaukee

Cleaning of streets and alleys, collection of ashes and rubbish, and kindred activities in Milwaukee employ about 175 pieces of equipment and utilize a working force ranging from 535 to 650 men. In addition, at time of snow storms, a great number of emergency men may be employed for a few days. An estimated 956,485 cubic yards of loose rubbish was hauled to the dumps in 1954, as well as 58,000 cubic yards of street sweepings. Eleven motorized Sweepers operated for 15,394 hours on regular routes.

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### **PUBLIC WORKS DIGESTS**

# The HIGHWAY AND AIRPORT Digest

### Skid Resistance And Surface Particles

Laboratory tests made in the Netherlands convinced the writer that the formula: friction = (a coefficient) (vertical load) is not valid for rubber on a smooth, clean surface, except when the surface is wet. When it is wet, it seems that a small number of sharp surface particles per unit area has the same effect on friction as a proportional number of smaller isomorphous particles; the height of the particles being inversely proportional to the square root of the number per unit area. This relationship is limited by the area of

contact surface and the dynamic penetration possibilities of the surface particles into the rubber, the latter depending on the quality of the rubber and on the tire pressure. It was estimated that, as an average, it is useless to make the particles higher than 2 mm, because they must then be less numerous than isomorphous smaller particles. The friction equation given above seems to be valid on a surface containing large particles, all of the same dimension and the same material.

"Relation Between the Skid Resistance of a Road Surface and the

Size of the Particles." By D. H. F. Obertop, Chf. Eng. of Road Material Laboratories, Wegen, October.

### Designing Off-Street Parking Lots

Well planned, attractive lots can improve the appearance of otherwise drab areas. The possibility of landscaping should not be overlooked; with low shrubs or grass if the unused areas are small. The shape and dimensions of the area will generally be fixed, and a general layout should be selected that will give the maximum number of parking spaces. Individual spaces should be generous enough to provide for the longer and wider cars now coming into use. There are three common arrangements of parking spaces: Perpendicular or 90° parking is most common; 45° parking is the next most common. Parallel parking may be used to fill up narrow strips. The article gives illustrations of different layouts. Consideration should be given to the location and protection of parking meters.

"The Design of Off-Street Parking Lots." Public Works, January.

### Aerial Engineering by Ohio's Highway Department

The Ohio Dept. of Highways has operated its own plane for making aerial surveys and taken its own photographs since 1946. They estimate that this effects a saving of up to 90 percent in time and manpower, and gives considerably more vital detail than would be practicable with ground surveys. They started with an engineer pilot, an aerial photographer who had been trained in the armed services, a war surplus plane and aerial camera. In 1955 the employees in the Aerial Engineering Section comprised 3 in administration; 5 in the photo lab; 8 field and 10 office men in the photogrammetry unit; 25 in the plan preparation unit; a total of 54 with salaries totaling \$247,128. Operating expenses brought the total budget for the year to

### High-Speed Method for Curb Footing Excavation



Courtesy International Harvester Co.

BLADE is examined by Ralph Thomas, foreman, and H. C. Gale, owner.

THE CURB footing excavation blade shown herewith, attached to an International Drott Skid-Shovel, will cut quickly and economically to 22 inches below grade. It is 28 inches wide, made of 34-in. steel plate; the angle forward

from the bottom of the bucket level is 15 degrees. This unit is being used by H. C. Gale, contractor of Harrisburg, Pa., for digging curb footings. Cost of construction was about \$100 to modify the blade for this purpose.



HOLMES-OWEN TRUCK LOADER provides worthwhile savings on such jobs as repaying, repairs and maintenance of streets, roads, parks, etc.



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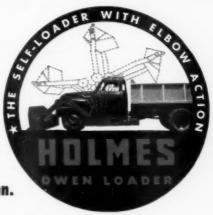
The HOLMES-OWEN LOADER is hydraulically operated, lifts ½ yard per bucket, loads the average truck in 4 minutes and can be installed on most any 1½ to 2 Ton Truck. For full information see your equipment dealer or write factory direct.

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# How high-speed loader keeps busy all year 'round

This heavy-duty, self-propelled, belt-type loader has a wide range of applications for highway departments. It loads practically any type of loose material out of windrows or stockpiles, it gets around fast from job-to-job... over city streets and highways at speeds to 26.7 mph.

### How it works

TraveLoader loads from windrows, stockpiles, or earth, sand or gravel borrow pits. It has a wide range of 5 working speeds from 0.29 to 1.9; has 5 travel speeds from 3.90 to 26.7. The floating, revolving, screw-type feeder automatically adapts itself to the load ahead and places a continuous flow

of material on the conveyor-belt. Trucks can be loaded with loose materials at up to 10 yards per minute. Trucks load behind loader, do not interfere with passing traffic.

### Heavy, durable construction

All-welded, box-construction, one-piece frame extends full length of machine. Heavy-duty front and rear axles, sturdy feeder mechanism, rigid conveyor with sealed-for-life roller bearings, give TraveLoader the necessary strength to handle heavy loads at fast speeds with minimum downtime and maintenance. Available with gasoline or diesel engines.

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You will like TraveLoader's centrallylocated control station...up out of the dust, permitting clear vision in all directions. Easy, fast, hydraulic controls, give quick adaptability to any working condition.

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\$285,828. The equipment used is valued at \$105,000. The author describes in outline the general procedures used in taking the photographs and utilizing them by the office forces for highway planning.

"Ohio Pioneers in Better Use of Aerial Engineering." By Duane L. Cronk, Editor. Roads and Streets, December.

# Hot-Mix Surfacing In Alabama and Tennessee

A survey of nine cities in these two states, with populations ranging from 6,500 to 175,000, shows hot-mix surfacing to be well out in front. Only one of these cities uses a cold mix for surfacing. Mobile uses two types of hot-mix, one with shell-sand for aggregate, the other with limestone rock. For streets where traffic is not extremely heavy, Mobile does not use cement concrete base, preferring either compacted sand-clay, shell-sand, or soil-cement.

"Hot-Mix a Two-State Leader."

American City, December.

### Culvert Designing And Installing

Full instructions are given by the engineer for a manufacturer of culvert pipe. Culverts should be designed of such capacity as not to flow full or with headwater submerging the entrance oftener than once in 25 years. Three methods are described for calculating the size of culvert, one by inspection of existing structures, the other two by use of empirical formulas. The application of these is affected by conditions of the inlet and outlet of the culvert. Other matters discussed are the location of the culvert: the grade of its invert; the length. Suggestions are given for installing, bedding, backfilling, etc. Four-color illustrations are used.

"How to Design and Install Culverts." By W. H. Spindler, Armco Drainage and Metal Products, Inc. Public Works, January.

### Lining Old Drainage Structures

When an existing drainage structure shows signs of failing or needs strengthening, it is often possible to salvage it by lining with new material. The author describes how to use corrugated metal for this purpose, either by skidding preformed pipe into it or by using tunnel lining type of material. Features requiring special attention are the permissible reduction in area of the opening; the foundation; and backfilling between the lining and the

existing structure. For the last named, sand or sand-cement grout is often the best material.

"Lining Can Save Maintenance ollars." By W. T. Adams, Armco Dollars." Drainage and Metal Products, Inc. The Highway Magazine, December.

### Increasing **Engineering Productivity**

With the rapidly expanding volume of highway work being done, there is an alarming scarcity of engineers for conducting it. This is being offset by methods for increasing the productivity of the engineers engaged in highway work, by streamlining existing procedures, extension of the use of photogrammetry and more intensive application of electronics in the planning, design, construction and operation of highways. Illustrations are the use of two-way radio; of electronics in truck weighing; industrial television; remote control of traffic lights; the resistivity method for subsurface exploration; electronic computers. These and many other methods of expediting the work required of engineers are discussed by the author.

"Increasing Engineering Productivity" By A. C. Clark, Deputy Comr., U. S. Bureau of Public Roads. Public Works, January.

### Electronic **Overload Detectors**

Three electronic scales and overload detectors, built into the highways to weigh trucks while they are moving, went into operation in October outside St. Paul and Minneapolis, and Minneapolis engineers contemplate installing 25 or 30 more. The detector installed near St. Paul is crossed by an average of 2,000 trucks a day; and two outside Minneapolis are crossed, one by 2,440 trucks and the other by 1,350. A scale house for static weighing is located a few hundred feet beyond each electronic scale. When an overloaded truck crosses the scale, the detector lights an electric sign reading "Go to the Scale," and flashing lights in the scale house notify the patrolman.

"Minnesota Tries Electronic Overload Detectors." Roads and Streets, December.

### Status of **Anti-Stripping Agents**

There are antistripping agents available on the competitive market which have successfully run the gamut of laboratory investigation and field performance. Industrial asphalts vary considerably in their



# How 1 machine does work of 2

Suppose your city maintains 1 or 2 landfill garbage dumps. A front-end loader at each dump might cover about 100 tons of garbage daily. Neither rig is kept busy full-time, but it isn't worth the trouble and expense to load them on trailers and haul them around to do other jobs.

Then you get a D Tournapull. Just one. On a typical day your highspeed, rubber-tired "D" completes a schedule like this:

8:00 A.M. Operator reports for work, climbs on Tournapull and drives off. No waiting for flatbed, no loading or blocking. 28 m.p.h. rig averages 10 to 15 mph through traffic.

8:10 A.M. Arrives at city garbage dump 2 miles from garage. "D" uses its dozer blade to level refuse and its 7-yd. Carryall-Scraper to load, haul, and spread sand cover. Instead of crawling, it runs at its tasks . cleans up entire No. 1 Dump by 10:45 A.M. Drives to next job.

11:00 A.M. Rig reaches second dump, 3 miles away, gets right to work dozing garbage.

12:00 Noon. Lunch hour.

1:00 P.M. Continues hauling and spreading fill. Digs trench for future garbage burial and stockpiles earth for cover material.

2:35 P.M. Tournapull finishes at Dump No. 2, is ready to return to Dump No. 1, or handle odd-job assignment. Foreman sends Tournapull to grade small city-owned parking lot downtown.

2:50 P.M. Arrives at site after 2mile drive. Removes dirt from parking lot and dumps it in old excavation a block away. "D" moves 70 cu. yds. hourly on 1600' cycle...in 2 hours levels lot to hold 60 cars. Next time Tournapull has a few spare hours, it will be used to self-load. haul, and spread gravel on the lot.

4:50 P.M. Operator and rig take off for yard, drive a mile through rush-hour traffic in 5 minutes, are back at garage before 5 o'clock.

Impossible for 1 machine to do all this work in 8 hours? It happens every day in cities which own D Tournapulls. Dallas, Texas, for example, works 1 "D" at 5 widelyscattered garbage dumps.

When "D" is ahead on land-fill jobs, this multi-purpose machine can be kept busy on other assignments such as hauling fill to low spots in roadways, cutting drainage ditches, landscaping city parks, and many other assignments beneficial to the taxpayers. Machine travels anywhere in city within a half-hour - without special equipment to load and haul.

Ask your LeTourneau-Westinghouse Distributor for job-proved facts and figures on how American cities are getting better service with D Tournapull. He also will be glad to show you this handy rig in action.

Carryall, Tournapull—Trademark Reg. U.S. Pat. Off.
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resistance to stripping, the higher viscosity grades usually showing best resistance. Siliceous rocks are generally the hydrophilic offenders: limestones, dolomites and basic igneous rocks are the water-repellent ones. Chief function of commercial additives is to change the surface chemistry of hydrophilic aggregates. The additives are usually cationic agents which perform this correction by influencing polarity phenomena. The effectiveness of additives in securing better bond with wet aggregates has been well established by research. Stripping is a problem with some hot-mix construction. Heat resistant additives developed by the manufacturers have been found effective but their use has introduced problems of heat control and storage.

"Anti-Stripping Agents—Pro and Con." By Malcolm L. Gordon, District Materials Eng., B.P.R. Roads and Streets, December.

### Reinforced Bituminous Surfacing on Old Concrete

As part of the pavement research program of the University of Michigan, 70,000 sq. yd. of old concrete pavement on the Willow Run Airport, which the University owns, has been resurfaced with bituminous material reinforced with welded wire fabric. The concrete pavement, built during World War II, was 6-8-in. portland cement, not reinforced, laid in 10 x 25 ft. slabs. It was hoped that reinforcing the bituminous surface would prevent reflective cracking over the cracks and joints in the concrete. Most of the resurfacing consisted of a 2-in, binder course reinforced with wire fabric, covered with a wearing course of 1 in. of bituminous concrete. Reinforcing was omitted on two sections to serve as a check. The reinforcing fabric was laid on the old concrete pavement well in advance of the pavers and this and the concrete sprayed with a quick-setting emulsion tack coat.

"Reinforced Bituminous Surfacing Added to Willow Run Airport." Engineering News-Record, Nov. 17.

### Other Articles

"Detroit Airport Pioneers Use of Fabric" in asphalt surfaces. Public Works, January.

"Kansas Uses Advantages of Contract Method to Maintain State's Large Highway System." By L. J. Siler, Eng'r of Maint. The Constructor, December.

"Estimating Rock by Seismic Surveys." A first experience. By Eugene B. Sullivan. Roads and Streets, December.

"California Methods and Experience in Cement-Treated Bases and Subgrades." Roads and Streets, December.

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# SIGNAL SYSTEM SPEEDS CITY TRAFFIC

THE signal system on Broad St., Philadelphia, Pa. was 25 years old, worn-out, and inefficient by modern standards. A study by the city's Traffic Engineering Section revealed that an ultra-modern control system could be installed for only half again as much as the cost of replacements necessary to keep the old system working.

The planners of the new system recognized the necessity of making available to Broad St. traffic every second of green or "go-ahead" time possible. Equally important was the need to make available the actual time required for crosstown traffic and pedestrian movement. The problem then was to maintain green signals on Broad St. until actual need to change them rose because of crosstown bound cars or pedestrians.

A method of automatic actuation of signals was required to achieve this end. In the system this "actuation" is obtained by the use of detectors, either magnetic or pressure, buried in the paving from 50 to 100 feet behind the intersection. However, the new Broad St. system is interconnected from one end to the other with a nerve center (almost an electronic brain) located in the basement of City Hall Annex. This center performs the following functions: (1) It receives impulses from detectors which count traffic movement on Broad St. and computes automatically the best cycle length for North and South movement; (2) it automatically decides upon the most efficient cycle for North and South movement combined, and sets it into operation: (3) under conditions such as heavy movement either North or South, it can "favor" the heavy movement thus expediting traffic flow. For example, it will aid inbound motorists and homeward bound motorists at night. Finally, at each corner of every intersection are located "pedestrian push buttons" to be used when



• JUNCTION control cabinet, part of the vehicle actuated traffic control system recently installed by Eastern Industries, Inc., on South Broad Street, Philadelphia. Upon completion the system will control traffic at 75 intersections.

pedestrians desire to cross. These are plainly marked and easy to operate.

The cost of installation for South Broad Street is \$110,000 and for North Broad Street is \$175,000 for a total of \$285,000. All installation work is being performed by crews of the Traffic Engineering Section. Upon its completion the entire system will contain 223 detectors, 16 miles of cable containing 13 wires, 4 miles of cable containing 9 wires

"OLD-TIMERS" parading on South Broad Street didn't need complex control systems in their heyday, but today's traffic demands modern signals. and 4 miles of cable containing 4 wires. It will use 3 master controllers and 75 local controllers. All control equipment and detectors were furnished by Automatic Signal Div. of Eastern Industries.



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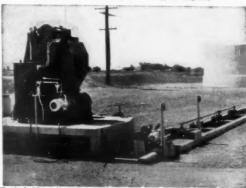
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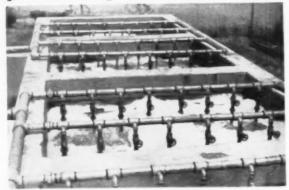
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# Cost of Utilities Installed by Developers

There were 604 residential building permits issued during 1955 by the City of Cuyahoga Falls, O. In the annual report of the City Engineer, T. H. Sauter, there is a summary of utilities installed by private developers which included the following: 29,703 ft. of sanitary sewers at a cost of \$89,109; 13,687 ft. of storm sewers at a cost of \$109,603,50; 29,635 ft. of water lines at a cost of \$88,905; 62,340 sq. ft. of concrete walks at a cost of \$31,170; and 5,400 sq. yds. of paving at a cost of \$13,-500. The homes served by these utilities included some of the 604 started in 1955 and additional ones from the previous year-nearly a thousand in all.

### Results of Exposure to High-Fluoride Water

A ten-year study was made of 237 persons, approximately half residing in a high-fluoride area (Bartlett, Tex.) and half in a control area (Cameron, Tex.). Drinking water at Bartlett contained 8 ppm of F, and at Cameron 0.4 ppm F. The study "clearly demonstrates" that, except for dental mottling, ingestion of water containing up to 8 ppm of fluorides, produces no deleterious changes; no unusual incidence of bone fractures, arthritis, hypertrophic bone changes or exostoses, or interference with fracture healing; no cases of "poker spine" and no evidence of associated functional or systemic effects. This study was reported by C. L. Nicholas and others in the Nov., 1955, issue of the American Journal of Roentgenology.

# Water Rates the Same Now as in 1904

Water rates have remained much as they were in 1904, per family unit in Augusta, Maine. Most of the residential customers are charged on the fixture rate basis; the charge now is \$14 per family per year, whereas in 1904 it was \$19. Rates have been occasionally reduced on the fixture basis, the latest such reduction being in 1944 when the rate for a kitchen faucet was reduced from \$5 to \$4 per year. Meter rates have been unchanged for many years, it never having been necessary to increase this category. In 1939 the wholesale rate was reduced from 7¢ to 6¢ per 100 c.f. for use in excess of 100,000 c.f. per 3 month period. This information is from the excellent Annual Report of the Augusta Water District.

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### **PUBLIC WORKS DIGESTS**

# The INDUSTRIAL WASTE Digest



### Saving Water by Automatic Controls

Automatic control of metal plating rinse waters is resulting in savings of 50 to 90% of the industrial water supply previously employed in the Spectranome Company of New York. The installation consists of two automatic conductivity controllers actuated by a conductivity cell, turning water off and on as changes of conductivity of rinse waters indicate. Plating rinse waters increase in concentration from the drag-in of chemicals. In uncontrolled rinsing, sufficient water is allowed to flow to assure low concentrations, resulting in costly waste of water. The automatically controlled rinse will permit economies in design of tanks used for batch collection of toxic rinse waters. Application of the method to automatic treatment of cyanide rinse is suggested by using level detecting devices to assure desired sequence of delivery of the rinse to a collection tank where it can be automatically chlorinated by means of a redox controller.

"Control of Metal Plating Rinse Waters." By J. B. Mohler, Metal Finishing Consultant, New Castle, Pa. Industrial Wastes, Nov.-Dec.

### Treating Pea Canning Wastes

The pea canning waste characteristics of the Green Giant Company cannery at Dayton, Washington, were observed to afford bases for waste treatment studies and to detect points where water saving might be effected. These observations indicated that the blancher overflow accounts for 30.2% of the total BOD but only 1% of the total waste flow. The blancher spray reel drainage was found to be the second most concentrated waste, and together with the blancher waste, accounted for 51% of the total BOD but only 3.1% of the total flow. With separate treatment of at least the blancher waste indicated, a pilot plant was established during the summer of 1954 involving the processes of waste cooling, clarification, and bio-filtration. Rates of recirculation employed were four and five to one; filter dosing was kept nearly constant between fifteen and twenty million gallons per acre per day; pH was controlled above 6.5. With the average BOD of the blancher wastes 32,760 ppm, that of the filter effluent 6,930 ppm, the average BOD reduction was 78.8%. It was concluded that under favorable conditions a high rate trickling filter may be used advantageously as a roughing filter on these segments of the wastes, thereby reducing the BOD of the cannery wastes discharged to the city sewers by 30 to 50 per cent.

"Blancher Waste Disposal by Trickling Filtration." By Gene V. Leete, Gilbert H. Dunstan, and Jesse V. Lunsford, State College of Washington. Industrial Wastes, Nov.-Dec.

# Air Pollution Dispersal to the Atmosphere

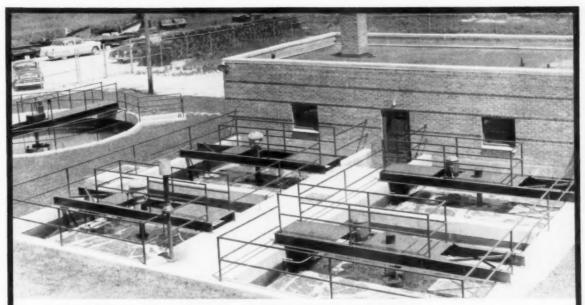
While natural phenomena affect waste dispersal to the atmosphere and these are largely uncontrolled, the factors of stack gas properties, topographic features, configuration and some plant thermal characteristics may be effectively studied in wind tunnel experiments. In these studies, scale models are used and scale factors are chosen such that the models are geometrically similar to the full-scale cases. Some dynamical aspects are not reproducible in the same geometric fraction as the models; for example, Reynolds numbers cannot be satisfied simultaneously with other scale factors. Thermal characteristics of the exposed surfaces of an industrial plant may have an important influence on dispersal of stack wastes, and these are being observed in the wind tunnel experiments at New York University. In the 31/2-ft. by 7-ft. tunnel with a 401/2-ft, test section, the model is placed 15 ft. from the beginning of the test section. Air velocities are controlled by a fan driven by a variable speed motor and by exhaust louvers. Mixing fans

are employed at the air intake to aid in achieving thermal equilibrium. Heating grids are used to produce desired thermal characteristics. An oil-fog type smoke is generated to permit visibility of the gas plume. Test results are recorded photographically, but more reliable quantitative data are obtained by measurement of diminution of light intensity with a phototube.

"Wind Tunnel Scale Model Studies of Air Pollution from Industrial Plants," (second of a series). By Gordon H. Strom, New York University. Industrial Wastes, November-December.

# Dust Removal in Uranium Processing

With the obsolescence of the warbuilt equipment for refining and processing uranium, it has been necessary to design replacement facilities. Experiences at many plants indicated that the major problem was to find equipment that would efficiently remove air-borne dust from exhaust system effluents. It was found that conventional cloth filter arrestors had basic disadvantages for this operation. Consequently the use of reverse jet aircleaning equipment was investigated. The experience of one plant utilizing wool felt reverse jet air cleaners manufactured under the Hersey patent is summarized. The average operating dust load for the individual collectors ranges from 0.002 to 32.0 grains per cubic foot. The peak in one conveying system is 100 grains per cubic foot and the over-all operating average dust load is about 5 grains per cubic foot. The average cleaning efficiency found during the two-year study on individual collectors ranged from 99.946% to 99.9996% with an average efficiency of 99.986% for all machines. The over-all costs, including a 5-year write-off on installation and all labor and maintenance is indicated to be \$0.23 per cubic foot per minute per year for equipment of adequate design.



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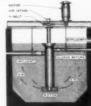
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- Aeration periods are shorter . . approximately four hours for average maximum flow. This means smaller aeration tanks can be used . . another feature which contributes to lower first costs.

- 6 No blowers or compressors are required. There are no diffusion tubes nor plates to be installed . . and maintained. There is nothing to clog. The simple mechanism requires the minimum of maintenance and attention.
- Detergent foam is disintegrated. Foam forming on the liquid surface is drawn down the draft tube into the highly turbulent and aerated zone of the rotor where it is destroyed.
- S Power consumption is no greater than that of conventional activated sludge plants . . yet purification efficiency is equal to if not better than that of any type activated sludge installation.
- Maintenance.costs are low.. the mechanism simple to service. The entire Cavitator unit can be removed for inspection without draining the tank.

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"Operating Economics of Air-Cleaning Equipment Utilizing the Reverse Jet Principle." By William B. Harris, U. S. Atomic Energy Commission, and Mont G. Mason, Mallinckrodt Chemical Works. In dustrial and Engineering Chemistry, December.

### Reusing Waste Water At a Refinery

At Sun Oil Company's Toledo, Ohio, refinery reuse of all suitable refinery waste waters in existing cooling tower systems has been accomplished. This is done by segrewith no pretreatment other than gation of waste waters at the source gravity separation for removal of oil and separable solids, followed by retention in an impounding basin for further equalizing and initial biological treatment. First step in the program was the installation of a flue gas stripping tower to remove sulfides in the process waste waters to be re-used. The second step consisted of completely segregating plant waste waters as to type and characteristics. Low alkalinity

waste waters and storm water drain through the existing refinery sewer system to an API separator for primary removal of oil and settleable solids. Oil-free waste waters. high in alkalinity and not suitable for re-use flow to the receiving stream. Oil bearing high alkalinity waste waters are delivered to a new auxiliary API separator for oil removal before discharge. An impounding basin with maximum liquid capacity of 8 MG provides storage, equalizing, removal of residual oil and preliminary biological treatment; it also serves as an emergency fire protection reservoir. Two 750 gpm pumps at the impounding basin return substantially all the low alkalinity process and storm water to existing refinery cooling towers asmake-up water. No pretreatment is provided other than gravity separation and impounding for five to eight days. No major modifications have been made to the existing cooling towers and cooling equipment.

A four-month period of initial operation showed phenol content in the re-use water has been reduced more than 99%; COD has been substantially lowered. Only small quantities of acid have been required to reduce alkalinity in the make-up water. Carbon dioxide contributes to lower pH, thereby reducing acid requirements.

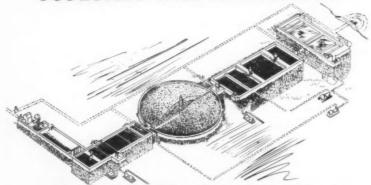
"Successful Initial Operation of Water Re-Use at Refinery". By Harold F. Elkin, Sanitary Engineer, Sun Oil Company, Philadelphia, Pa. Industrial Wastes, November-December 1955.

### Fertilizer from Acid Wastes

The Rohm & Haas Chemical Manufacturing Company treats its wastes in a plant costing \$1,200,-000. The largest part of the wastes is 350,000 lb. per day of dilute sulfuric acid. This is neutralized with ammonia and evaporated to crystalline ammonium sulfate, which is sold to fertilizer plants. Several fertilizer companies also take the phosphoric acid wastes for use in converting phosphate rock into triple super phosphate. Hydrochloric acid wastes are passed through a bed of high calcium limestone and converted to calcium chloride. Wastes from insecticide manufacture are treated by intensive chlorination followed by trickling filtration.

"Sulfuric and Phosphoric Acids Wastes Converted to Fertilizer." Wastes Engineering, December.

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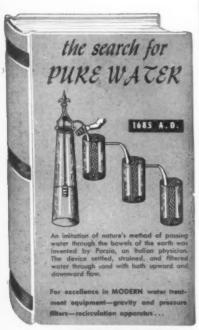
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# Activated Sludge for Packing Wastes

The Braun Brothers Packing Company of Troy, Ohio, constructed an activated sludge plant to treat its industrial wastes. Design for the plant was on the basis of 1,000 hog units with a waste flow of 550,000 gpd having a total BOD load of 4,000 pounds per day; 85% removal was to be attained. Flexibility was provided by making possible chemical pretreatment if such was necessary to increase the BOD removal in the primary tank. Basic design was with the understanding that paunch manure would be removed by special settling tank and filter, but this arrangement was not followed by the owner; consequently the paunch manure is discharged to the treatment plant sewer.

Waste flow starts at 7:00 AM and continues at a comparatively low and erratic rate until about noon; during the next 5 hours the bulk of the waste is received at an extremely high rate. During the next 14 hours there is no waste flow. Arrangements are made to utilize the available 14 hours for treatment or double aeration of the bulk of the wastes produced in the earlier part of the day.

In spite of the additional load from paunch manure, the treatment plant has consistently shown a higher efficiency than the required 85%. The packinghouse currently is processing slightly more than 1,000 hog units per day at a waste flow of about 400 gpd per hog unit. Averages for the years 1953 and 1954 show a flow of 0.386 MGD with 3220 ppm suspended solids and 1860 ppm BOD with 96.8% removal of suspended solids and 96.1% removal of BOD. The plant is operated by one operator who reports to the owners of the plant.

"Packinghouse Wastes Treated by Activated Sludge." By Paul A. Uhlmann, Uhlmann & Associates, Consulting Engineers, Columbus, Ohio. Industrial Wastes, Nov.-Dec., 1955.

### Concrete Pipe Jacked Under A Freeway

THE SECTION of the San Bernardino Freeway which extends from West Covina over Kellogg Hill and connects to the completed freeway through Pomona, Calif., is in terrain that is mountainous and has many cross canyons and high fills. To replace the cross drainage by open cut method was prohibitive — first, because the height of the existing fills

was so great, and secondly because public traffic had to be maintained. Therefore, the contract provided for jacking under the freeway approximately 2,000 ft. of reinforced concrete pipe ranging in diameter from 24 to 54 inches.

The contractor had the option of using 30-inch pipe in lieu of the 24 and 27-inch sizes to provide more working room. Consequently, 30-inch pipe was used at all locations where smaller pipe was specified. The jacking pit was usually set up at the downstream end of the line and the pipe was jacked upgrade. This was done to prevent any water from staying in the pipe heading.

The lengths of the lines to be jacked varied from 160 to 330 ft. and these were all jacked from one jacking pit at each location. The setting up or installation of the jacks, rails and backstops called for very close accuracy for line and grade as the specified tolerance allowed only 3 inches per 100 feet variance in line and grade. The complete jacking operation at each location was performed by two men One inside the pipe with a short hand operated pneumatic clay spade and shovel and the other man operating the air tugger winch which pulled the dirt sled in and out. The man working in the pipe would excavate approximately two feet ahead of the pipe and then it would be jacked up snug against the dirt heading. Line and grade control was the sole responsibility of the man working in the pipe and was done by neat grading for the perimeter of the pipe up to approximately 18 inches above the flow line.

### Checking Alinement

At frequent intervals, field checks for line and grade were made with instruments and the variation from the theoretical line and grade was determined. The crew would then try to work back to the theoretical line. Although the end pipe would hole through within 6 to 10 inches of the theoretical location, the pipelines as laid, especially those over 150 ft. in length, would be a series of small deflection. The average day's work would run between 8 and 10 feet of pipe jacked in a 10-hour shift. Each section of pipe was coated with Bentonite rotary mud for lubrication and was butted against the adjacent section of pipe with a one-half inch mortar pad for bearing. The new pipe sections were usually placed at the end of each shift so the mortar could set up during the night. Two 75-ton hydraulic jacks were used on the 30-inch diameter pipes and two 200-ton jacks were used on the 54inch line.

The key to successfully jacking the long lengths of RCP on this contract was the soil condition. The old fills were well compacted and no large boulders or rock were encountered. The material was such that it would tunnel and hold its shape—the result being there was no overhead displacement or load on the pipeline being jacked. Any vertical load would have made jacking impossible. The pipe seemed to jack smoothly up to around 200 ft. of length but from then on considerable stress was evident, with small chips spalling out at the joints. There was a total of 1815 feet of pipe jacket on this freeway construction project.

This is condensed from an article in California Highways and Public Works by Robert M. Innis, Resident

Engineer on the Project.

### **Driveway Regulations**

(Continued from page 117)

ing jurisdiction. There are two classes of permits: B-1 permits are for the construction of farm drives and other minor installations inside highway right-of-way not affecting the geometric design or use of the highways; and B-2 permits, which are for construction affecting the design of the highway or its use. This includes traffic crossovers through medians, approaches to service stations, drivein theatres, stores, factories, warehouses and overhead structures, the use of which materially affects traffic.

An application for permit must be accompanied by a detailed plan showing all of the proposed construction affecting traffic movements, including such information as the exact location of the property; the dimensions and property lines; the width of proposed and existing drives and the radii involved; and the dimensions and types of construction

of proposed islands.

The Division Engineer examines these plans to see that they comply with the Department's standards of safety and efficient traffic flow, and also supervises the work performed under the permit to see that it complies with the requirements of the Department. This is done in order to protect the state from liability for claims due to negligence of the permit holder, and to protect the interests of the Highway Department.

In acting on applications the Division Engineer is guided by Department policy with regard to location and purpose of the entrance as well as design. For example, the Department will not grant permits for access on limited access highways or grade



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separation projects, nor will it grant concessions in Roadside Parks or within highway rights-of-way. Permits are not granted to abutting property owners where highway rights-of-way have been acquired by easement until the terms of the acquisition have been checked and found not to be violated.

However, each permit is judged according to its own special circumstances, and in unusual cases the Director of Highways may authorize exceptions, when they are deemed desirable and are not incompatible with public safety and welfare.

In addition to its policies as to location, the Department has a published body of regulations concerning actual design of entrances and exits for service stations. This was prepared by a joint committee of Highway Department officials and representatives of the petroleum industry of Ohio. These regulations governing service station driveways are used wherever applicable in other commercial driveway planning, and are the basis for consideration of class B-2 permits. Because of their limited use, private driveways are less restricted as to design, except in unusual cases, but they must comply with Highway Department policy with regard to location.

If the approaches are at a corner, they must not begin nearer the highway intersection than the point of intersection of the extended property line or R/W line, with the curb line, or with the pavement edge if there is no curb. The beginning of the approach need not be more than 20 feet and must not be less than twelve feet from the angular bisector measured along the face of the curb or the pavement edge.

Where there is a sidewalk, however, the approach shall not begin nearer the corner than the back edge of the sidewalk.

Where the effective radius of the arc at the corner is greater than 25 feet, the approach shall not begin closer to the angular bisector than a distance equal to one-half of the effective radius of pavement edge or curb, except at an obtuse intersection greater than 120 degrees, in which case the approach shall not be less than twelve feet from the angular hisector.

There are several general regulations covering approach design:

Approaches must be located far enough from an intersection so that cars using them can cross the intersection in the normal traffic pattern.

The interior angle between the axis of an approach and the center of the roadway shall fall between 45 and 90 degrees.

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The width of all approaches shall not be greater than 35 feet in the throat of the approach measured at right angles to its axis. The approach may be flared at the edge of the highway to allow safe, easy turning of the vehicle using it. Where the flared edge controls the turning radius of vehicles entering by a right turn from the adjacent outside traffic lane of the roadway, the radius of the edge shall be as long as practical, to provide free and safe turning movements, but must be at least three feet.

Where there is an adjoining public alley, the approach may begin at the far side of the alley, and if this is done, its width is included as part of the approach opening.

Approaches constructed on public property or right-of-way must be comparable to the abutting pavement except that, on minor roads with low-type pavement, an approach of an all-weather stabilized material may be constructed.

If the road is curbed the approach must also be curbed through the arc of the radius. Between all approaches there must be intermediate islands at least six feet long, measured at the property line. Where there are sidewalks, at least six feet of safety curbing must also be provided between approaches.

On rural roads and highways where there is no curbing or paved berm, and where there is a high volume of traffic and a maximum speed limit, the berms may be paved for 175 feet on both sides of the approach. This paved berm shall be not less than eight feet and need not be more than ten feet wide, conforming as nearly as possible, within these limits, to the existing berm width. The ends of these paved berms shall be tapered from one foot to the full width in 75 feet, the taper being included in the overall length. The transverse slope of the paved berm shall not be less than 1/4 inch, nor more than 34 inch per foot sloping away from the pavement edge

When a highway is divided by a raised or depressed median, the design of openings across this median will be governed by factors influencing the design of the highway. If it exists prior to the construction of the driveway, the median shall not be cut.

However, in design, as in location, special factors are taken into consideration, and the highway division having jurisdiction may make modifications so long as they are consistent with highway safety and efficient traffic flow. Regulations must be enforced to govern the driveway traffic.

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# **EQUIPMENT NEWS**

Published Monthly

February, 1956

### Plastic "Jiffy Joint" for Clay Pipe

A new plastic-jointed vitrified clay sewer pipe-Plastic Jiffy Joint Pipe-has been announced by Cannelton. The new joint is made of red polyester plastic, die-cast permanently on the spigot end of the pipe at the factory. The bell end features a precision-cast bituminous socket that provides the flexibility needed for permanently tight joints. The plastic collar on the spigot end is made of heat-setting Polyester. High temperatures makes it hard-not soft. As a result, it can be stored indefinitely under blazing sun with no danger of softening or deformation of the spigot joint. In addition, the plastic collar doubles the impact strength of the spigot end so that careless handling by inexperienced personnel does not result in high breakage loss. Plastic Jiffy Joints can be made with great speed because only two steps are involved. First, the bituminous socket on the bell end is painted with Jiffy Joint solvent, and second, the plastic spigot



Joint has die-cast plastic collar at bell end and a cast bituminous socket

is pushed home with a slight spiral motion. It is not necessary to paint or swab the plastic collar. Four-foot lengths of the pipe are available in four-inch diameters, and three-foot lengths in six-inch diameters. Full information from the Cannelton Sewer Pipe Co. Cannelton, Ind., or circle No. 2-1 on the coupon.

rate. The conveyor, which comes in 16, 19, 22 and 27-foot lengths, is designed with a trough shape to carry approximately 30 percent more material than a flat belt of the same width. The high-speed belt delivers material in a stream which shoots clear of the end of the conveyor. The carrier can be raised quickly to a perpendicular position for traveling from job to job. In addition to scrapers and brush guards which dislodge foreign matter from return belt rollers, there is an extended lower lip at the feed end of the conveyor. This lip protects the belt from damage by objects entering the conveyor and prevents the plow disc from coming in contact with the belt. Installation of the Elegrader is simple for it requires no cutting or welding and involves the drilling of only five holes. For additional information write Le Tourneau-Westinghouse Co., Peoria, Ill., or circle No. 2-2 cn the coupon.

# Improved TraveLoader is Announced

An improved Adams TraveLoader and a number of changes in engines and horsepower ratings in their line of Adams motor graders have been announced by LeTourneau-Westinghouse. The TraveLoader is a self-propelled, belt-type loader for handling all types of loose material into trucks from either windrows or stockpiles. A rocker-type foot pedal operating an over-center clutch now controls the starting and stopping.

### Elevating Graders Added by LeTourneau-Westinghouse

The Reisser Elegrader has become the latest addition to the LeTourneau-Westinghouse line of earthmoving equipment Designed to extend motor grader usefulness, the Elegrader transforms the standard, one-man operated grader into an all purpose tool for loading, casting, terracing, ditching, widening and stripping. Built for use with the Model 550, 610 and 660 Adams motor graders and also for attachment to the Caterpillar No. 12 grader, it will handle up to 1500 cubic yards of material an hour on side casting; the 22-foot carrier length machine loads trucks or other hauling units at a consistent 12-yard per minute



Elegrader handles a truck loading assignment on a highway



Stockpiles and windrows disappear quickly with TraveLoader

stopping and no spring clutch. Other There are no gears to shift when improvements include a shorter paddle-type feeder for placing material on the conveyor belt; and feeder cross shafts have been eliminated thus enabling the machine to load occasional large rocks, slabs of concrete or chunks of asphalt without damage to the feeder. The machine has a loading capacity up to 10 cu. yd. per min, in loose material and up to 20 cu. yd. in snow. The Adams No. 660 motor grader is now powered by a 150-hp engine, the No. 550 is now equipped with a 123-hp, engine, the No. 440 is offered with a 100 or 104-hp. engine and the No. 330 may be had with a 75 or 80-hp. motor. For full details on these machines write Le Tourneau-Westinghouse Co., Peoria, Ill., or circle No. 2-3 on the coupon.

### A Luminaire Designed for Better Lighting

A new Pfaff & Kendall fluorescent luminaire is available for use in lighting white-ways, tunnels, underpasses and parking areas. D:signated the Luxaire, the luminaire



Fluorescent luminaire made by P & K

features rapid, simple mounting on existing poles, or on companion-designed P&K Davits or Standards. This luminaire is capable of producing 40% more light than filament type lamps, using the same energy. The quality of light is free from glare and is excellent in retaining color values. More information from Pfaff & Kendall, 84 Foundry St., Newark 5, N. J. or circle No. 2-4 on the coupon.

### Crawler and Wheel-Type Tractors For Many Uses

The new "Handyman" John Deere "420" Series Tractors—crawler and wheel type—closely resemble the John Deere "40" Tractors, which they replace; but the new 2-cylinder, valve-in-head engine, which is common to both models, delivers approximately 20 percent more

### New Models of Quick-Way Truck Shovels



The all-new "Quick-Way" Model 100, one of the four new machines announced by the Quick-Way Truck Shovel Co., Denver, Colorado, and described in this section last month. Shown above is the 10-ton, ½-yd. machine. For full details check No. 2-5.

power. The drawbar horsepower is increased from 20 to approximately 25. Additional power is attained primarily by changes in the bore, the cylinder head, valve mechanism, manifolding and carburetion and by the new compression ratio of 7 to 1. A pressurized cooling system with water pump and thermostat replaces the thermo-siphon system formerly used. Other features include low and compact construction, quick maneuverability, "live" hydraulic system, adaptability to a wide variety of work, low initial and operating costs and ease of maintenance. For full details write John Deere Co., Moline, Ill., or circle No. 2-6 on the coupon.

### Street Broom Attachment for Light Tractors

The Shawnee street broom attachment for light tractors is a recent addition to the Shawnee line of



Broom mounts on industrial tractors

hydraulically controlled tools. It is designed to adapt to almost any make front end loader. The broom is operated by a hydraulic motor and can be angled left or right as much as 30 degrees. The India

Palm Broom core measures 7' wide and is 24" in diameter and is equipped with a stabilizer wheel to eliminate bouncing on rough streets. The attachment can be installed or removed from the tractor in approximately 10 minutes. For more data write Shawnee Mfg. Co., Inc., 1947 N. Topeka Ave., Topeka, Kans., or circle No. 2-7 on the coupon

### Compact 1500-watt Generator

Small size, light weight, close voltage regulation and generous overload capacity are among the many big features combined in the new 1500-watt generator announced by Homelite. It is a 115-volt, 60-cycle AC generator, developed for use by utilities, contractors, builders, construction men and municipal departments. It will operate all types of portable electrical tools and provide standby power in emergencies. Equipped with four conveniently located outlets, it can operate several tools simultaneously. For further information write Homelite, Port Chester, N.Y., or circle No. 2-8 on the coupon.



90-pound generator delivers 1500 watts for portable tools and emergency use



Caterpillar No. 12 motor grader with hydraulic attachments



Pneumatic compactor operates in 5 to 20-ton range. Power including shiftable moldboard, snow plow and snow wing steering enables unit to turn around in a 20-ft. roadway

### Hydraulic Attachments for Caterpillar Motor Graders

A complete new set of hydraulic attachments for No. 12 and No. 112 motor graders has been announced by Caterpillar. They include the hyshiftable moldboard, draulically snow plow, bulldozer mounting and snow wing. The new shiftable moldboard is concave in shape to allow for the hydraulic cylinder. Standard moldboards will be equipped with a slide bar in place of the cylinder to allow for manual offset of the blade. Improved design and strength are featured in the new snow plow and bulldozer mounting. The cylinder is controlled by a four-position valve that allows floating but gives down pressure when desirable. Two cylinders are mounted on the mast to control the cable that supports each end of the snow wing. This type of control will give greatly increased speed for moving the wing around poles, fences and guard rails. Power for the attachments is supplied from a new enclosed hydraulic system, similar in design to other Caterpillar hydraulic units and mounted on the front of the dashboard between the frame members. Valves, located inside the reservoir, can be stacked to allow any or all of the attachments to be used together. For more data write Caterpillar Tractor Co., Peoria, Ill., or circle No. 2-9 on the coupon.

### New 1/2-ton and 1-ton Hand Winches

Four new, lightweight hand winches are announced by Beebe Bros. Weighing only 20 lbs., the new 1/2-ton Model A-3 Beebe winch has a gear ratio of 5.3 to 1. and is the smallest of the four new models and is available with either 3-in. or 6-in. wide drum, Also available is the new 1-ton Model B-3 and B-6, with 3-in. and 6-in. drums, respectively. The one-ton units have two speeds of 5.3 to 1 and 10.5 to 1. Special high-tensile bronze drive pinion and external gear unit give these rugged winches exceptional long-life. A two-way, spring-operated dog permits safe operation in either direction and the dog may also be locked in neutral for free spooling. The 131/4 in. double socket steel handle provides extreme leverage for heavy loads or fast take-up on the center socket. For further data write Beebe Bros., 2724 Sixth South, Seattle 4, Wash., or circle No. 2-10 on the coupon.

### A New Mechanical Joint For Vitrified Clay Pipe

Rapid construction of house connections is made possible by the use of the new Speed-Seal mechanical



Mechanical joint uses rubber gaskets

joint for vitrified clay pipe. Installation involves only placing a rubber gasket on the spigot, brushcoating gasket and spigot with lubricant and shoving the spigot into the bell. The assembled compressed gasket forms a permanently-tight, permanently-flexible mechanical joint. A standard 4-foot length of Speed-Seal pipe will deflect at least 4" from a straight line with complete safety, For full data write Gladding, McBean & Co., 2901 Los Feliz Blvd., Los Angeles 39, Calif. or circle No. 2-11 on the coupon.

### Pneumatic Tired Road Compactor

A new design in heavy pneumatic tired road compactors, announced by Seaman-Andwall is self-propelled and capable of road speeds up to 20 mph for easy transport to the job. Equipped with power steering for high maneuverability, it can easily make a 180° turn on a 20-foot roadway. With 9 pneumatic tired wheels on the rear and 8 on the front, the compactor provides a "straight down" pressure even in turning to eliminate pushing action, surface shear, scuffing, and material displacement. Four 500-gallon compartments provide for liquid or sand ballast. Variations in road weight range from 5 tons empty to 15 tons with water or 20 tons with sand ballast. For further details write Seaman-Andwall Corp., 266 North 25th Street, Milwaukee 1, Wisc., or circle No. 2-12 on the coupon.

### **High Visibility Street Name Signs**

A clearly legible street name sign of aluminum construction with "Scotchlite" reflective facings has high visibility night and day. Teardrop cross section design projects the legend down to the eyelevel of pedestrians and motorists. For full details write Traffic & Street Sign Co., Newark, N. J., or circle No. 2-13 on the coupon.



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Wain Roy corp. Dept. C Hubbardston, Mass.

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### CLASSIFIED ADVERTISING

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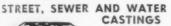
Civil Service Commission City Hall Cedar Rapids, Iowa

### CITY ENGINEER WANTED

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# Bituminous Paver Features Controlled Compaction

A new bituminous paver announced by Pioneer is specifically designed to give controlled compaction and uniform density of mat from any reasonable mix at a high laydown rate. Key units of the new paver are its "Vibromatic" screed and compactor. The oscillating screed, consisting of a toothed strike off and a precompactor, fills in the voids across the entire width of the mat being laid. Following the screed is a high-speed vibrating compactor, heated across its full width, which irons out the surface of the mat to a uniform density. Thickness of mat is controlled by a simple adjustment of independently operated screws, one located on each side of the screed assembly; depth of mat is adjustable up to 10". Detailed specifications may be obtained from Pioneer Engineering Works Inc., 1515 Central Avenue, Minneapolis 13, Minn., or circle No. 2-14 on the coupon.

### Barricades with Flasher Safety Lights

A new self-contained battery powered warning light and folding barricade, designed to provide safe, effective, low cost traffic control, is announced by F. D. Fageol. The warning light produces brilliant neon flashes, visible for over 1 mile, at a rate of 90 flashes per minute. Power is supplied by a 6-volt battery. Flasher safety light barricades are of steel angle iron and 34" exterior grade plywood construction.



Designed for use with one or two flasher safety lights, the barricades are painted highway safety yellow or white and black. They are 42-in. high and available in three widths: 24-in.; 36-in. and 48-in. For further information write to R. D. Fageol Company Box 328, Kent, Ohio., or circle No. 2-15 on the coupon.

### New On-Job Barrel Heater Announced by Tarrant

This new, portable barrel heater, specifically designed to allow onthe-job warming of liquid materials in the original shipping drum



has been announced by Tarrant. Especially adaptable to heating bituminous liquids, the heater simplifies cold weather pavement construction and maintenance work. Ruggedly built and designed to be fired by either bottled gas or kerosene, the Tarco Heater weighs only 200 lbs., and can be loaded and operated by one man. It is entirely constructed of sheet metal and iron parts and is equipped with wide tread steel wheels to assure easy handling. A controlled

flame and specially designed heat diverting baffles apply heat evenly to the entire surface of either side or end bung barrels, thus eliminating over-heating and the hazard of flash fires. For additional information, write Tarrant Manufacturing Co., 27 Jumel Place, Saratoga Springs, N.Y., or circle No. 2-16.

### Sanitary Engineer Available

Well-equipped sanitary engineer, 42, with wide experience in industrial waste treatment, state sanitary engineering and sewage treatment plant operation, now employed, is available. Field officer of the Sanitary Corps during World War II. Recommended by Editor of Public Works. Address Box 2A, Public Works Magazine.

### Ohio Sewage and Industrial Wastes Treatment Conference

The 30th annual meeting of the Ohio Sewage and Industrial Wastes Treatment Conference is to be held June 13-15, 1956, at the Carter Hotel, Cleveland, Ohio.

### PERSONAL NOTES

ROBERT K. HORTON has been appointed Assistant Director of the

Ohio River Valley Water Sanitation Commission. He has been a member of the Commission Staff since 1949; during the war he served in the Sanitary Corps and afterward with the Institute of Inter-American Affairs.

CHARLES M. WEISS has been appointed Associate Professor of Sanitary Science, Department of Sanitary Engineering, University of North Carolina. He received his doctorate from Johns Hopkins University in 1950.

H. E. HUDSON, Jr., formerly of the Illinois State Water Survey, is now associated with Hazen & Sawyer, consulting engineers of New York City. A graduate of the University of Illinois, he has had extensive experience in water supply and purification. He served in the Sanitary Corps of the Army during World War II.

GEORGE J. NATT has been appointed as Director of the West-chester Co., N. Y., Water Agency, succeeding S. P. Carman, who has returned to private consulting practice. Mr. Natt was Senior Engineer of the New York State Water Power & Control Commission prior to this appointment.

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# Worth Seeing





Tricky interchange resulting from a major road relocation by the Maryland State Roads Commission. Here U. S. Route 40 winds around a mountain at an elevation of 2750 feet. A deep cut, large fills and a small temporary bridge were required.



Automation strikes again! This is American Bank Equipment Company's "Collectall" which, with a ticket for overtime parking, takes money for the fine and issues a receipt.



Modern monster mounted on an International TD-24 diesel crawler tractor is shown in use by a contractor clearing 23,000 acres of brush and timber for a new reservoir.



Neptune Meter Company's new Pacific Coast headquarters provides facilities for warehousing, testing and service.

# What's your GATE VALVE MORTALITY



on installations requiring frequent opening and closing?

REPLACE them

# with G-A FLOWTROL VALVES

✓ Use the Angle Body and Save the Price of an Elbow Fitting

√ Built to Last a Lifetime

 ✓ Operates with Finger Pressure



### HERE'S PROOF:

One of America's large railroads had a 6" gate valve installation that operated on the average of 55 times a day. In addition to frequent repairs, this valve had to be entirely replaced every 3 months.

entirely replaced every 3 months. In the Fall of 1947, this valve was replaced with a 6" G-A Flowtrol Valve. Now—more than 7 years later—this valve is still operating perfectly and not one parts replacement has been made!

Want to know more about this unique valve? Write for Bulletin W-8A today.



Designers and Manufacturers of VALVES FOR AUTOMATION



# WORTH TELLING

### by Arthur K. Akers

- ★ J. D. (DON) ANDERSON is new general sales manager, the Jaeger Machine Co., Columbus, Ohio, succeeding J. H. Yearling, now director of market promotion.
- ★ AUSTIN-WESTERN CO., subsidiary of Baldwin-Lima-Hamilton Corporation, will now be known as Austin-Western Works of that corporation. No decided changes in personnel or operations are contemplated, it is stated.
- ★ WORTHINGTON CORPORA-TION has combined its Holyoke, Mass., works and sales operations





Ar. Finn

Mr. Laramy

in "the Holyoke Division," with William A. Finn its general manager. John B. Laramy is named assistant general sales manager of the Corporation, at Harrison, N. J.

- ★ TRAFFIC AND STREET SIGN CO., Newark, N. J., announces that William H. Spurgeon, formerly general manager, is now associated with United Advertising Corporation, Newark. United designed and erected all directional and traffic control signs along the 118 miles of the New Jersey Turnpike.
- ★ TONCAN CULVERT MANU-FACTURERS ASSOCIATION has elected Bruce Taylor president; J. Franklin Beall vice president; J. M. Wood secretary-treasurer; and Col. Hubert E. Snyder managing director.
- ★ MIXERMOBILE MANUFACTURERS, Portland, Oregon, announce these reorganization appointments: G. H. Wagner becomes president; V. C. Dirksen is named sales manager; and Glen Ede is sales promotion manager.

- ★ SAMUEL BURGESS, Vice President of Nichols Engineering and Research Corporation of New York, died January 5th after a short illness. He had had a long experience in the refuse incinerator field, following earlier construction connection with the Canadian National Railroad and the Panama Canal.
- ★ HENSLEY EQUIPMENT CO., San Leandro, Calif., adds seven new exclusive dealers in the West for its line of dozer and scraper rippers and allied tractor replacement parts.
- ★ ENTERPRISE ENGINE DIVI-SION, has delivered the first of four huge tri-fuel diesel engines at the Bowery Bay Pollution Control Project, New York City. It also appoints J. C. MacMillan Minneapolis district manager.
- ★ LINE MATERIAL CO., Milwaukee, advances Sales Manager Earle W. Williams to vice president, marketing and sales. Wilson M. Dusenberry becomes sales manager.
- ★ MARSHALL L. HOUGH, president of Darling Valve and Manufacturing Co., and H. Lloyd Nelson of the United States Pipe and Foundry Co., Birmingham, are among the water works industry's losses by death in December.





Mr. Nelson

Mr. Snyder

- ★ GULF STATES ASPHALT CO. appoints K. T. Snyder Co., Houston, Texas, national sales agents for the Gulf-Seal line of sewer pipe jointing compound.
- ★ LATEST DEFINITION: A specialist is a man who knows more and more about less and less.

4-wheel-drive
PAYLOADER does
two important jobs
on sewer project ...

# Cushion and Cover





The "PAYLOADER" tractor-shovel on this sewer job is one of three all-new, four-wheel-drive sizes by Hough, the pioneer and leader in four-wheel-drive shovel manufacture. Each size is way ahead of its class in digging power, carrying capacity, stability, safety and operator comfort. Each features the amazing new Hough bucket action that has tremendous pry-out force and 40 degree break-out at ground level.

There's also torque converter drive, more horsepower per bucket capacity and many other proven Hough advantages that lower the cost of digging, scooping-up, loading, moving and piling earth and bulk materials. Your Hough Distributor is anxious to show off these greater new "PAYLOADER" units and what they can do for you.



PAYLOADER<sup>®</sup>

THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.



Construction of this sewer, using 24" clay pipe, calls for the placing of a base of gravel under the pipe. The 4-wheel-drive model HH "PAYLOADER" picks up the gravel from piles on the opposite side of the busy highway and scatters it in the trench behind the ditching machine. It then goes to the rear and backfills until it is again needed to gravel another section.

THEFT BY	N 8 8 8 W	-62	HEAL	HOLL	00
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Send full	information	on	new	4-wheel-drive
PAYLOAL	DER units.			

- Model HO (2 yd.)
- ☐ Model HH (1½ yd.)
- Model HU (1 yd.)

Name Title

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City ...

State ..



CITY OF DALLAS

TELEPHONE RA-2491

DEFARTMENT OF WATER WORKS 2125 COMMERCE STREET

2605 Shore\_Crest Drive Dallas 19, Texas January 20, 1955

Wallace & Tiernan 1112 National City Building Dallas 1, Texas

Gentlemen:

In enswer to your recent inquiry, the Water Purification Division of the City of Dallas Water Department purchased its first chlorinator of the Wallace and Tiernen Water Diaphragm Type in April 1924.

Twelve chlorinators employing the water disphragm principle have been purchased from your company for use in our system to protect and insure our water supply against the transmission of water borns diseases.

Just recently we completely reconditioned for the first time one of the chlorinators that had been in continuous service for over 17 years.

The performance of all these machines has been excellent and they have required only routine maintenance for dependable service.

Very truly yours,

Supervisor

water Purification Plants

"....CONTINUOUS SERVICE

for over 17 years."



sought out new designs, principles and materials. Every new development is placed under rigid field tests to prove it can meet the exacting standards that dependable and economical chlorination demands.

When you depend on W&T equipment, you have the assurance that 40 years of experience in the chlorination field is being used to bring you the best in design, parts and materialsselected for long life and dependable service.

In Dallas, Texas, The Water Purification Division recently "reconditioned for the first time one of the chlorinators that had been in continuous service for over 17 years", according to Mr. Ben L. Grimes, Supervisor, Water Purification Plants. This dependability and long life result not only from proper design, but from the selection of the right parts and materials for every specific purpose.

Since 1913, W&T research has consistently



WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

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